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JONES (E. P.). **Entomological Review : 1934.**—*Publ. Brit. S. Afr. Co.* no. 4 pp. 3–9. London, 1936.

In Southern Rhodesia, the total loss from insect pests suffered by the 1934 crop of *Citrus* of the British South Africa Company only amounted to 2·55 per cent. and was confined to limited areas. Of this, 1·69 per cent. (slightly more than in 1933 [*cf. R.A.E.*, A **23** 409]) was due to *Aonidiella aurantii*, Mask., not including the loss from 5 groves that had always been the most subject to attack, and in which over 50 per cent. of the crop was damaged. The dosage of [sodium] cyanide for the fumigation of some of the badly infested groves was increased to 1 oz. per tree, and in December a proprietary oil spray was applied ; but (contrary to the 1933 results) the kill obtained by the spray was unsatisfactory. Infestation by *Scirtothrips aurantii*, Faure, was mild. Nicotine (98 per cent.) was sometimes substituted for nicotine sulphate (40 per cent.) in the normal lime-sulphur sprays for this thrips, the concentration being reduced by half. There was no loss in the 1934 crop from *Heliothis armigera*, Hb. (*obsoleta*, F.), which attacks the young reproductive stages, or from *Coccus* (*Lecanium*) *hesperidum*, L. Some of the few individuals of the latter present were parasitised by larvae of a Cecidomyiid, sometimes 2–3 being found in one host. An oil spray that had controlled *A. aurantii* in 1933 gave such poor results against *C. hesperidum* on young trees, that resin wash had to be used. Nicotine sulphate was included in the first application of the lime-sulphur spray during the 1933 treatments against thrips in order to control *Aphis tavaresi*, Del Guerc., but small, sparsely distributed colonies of this Aphid caused a loss of 0·69 per cent. of the fruit. Swarms of the red locust, *Nomadacris septemfasciata*, Serv., damaged the fruit and the foliage, particularly the young growth, of the *Citrus* trees, but were disturbed and forced to continue their flight. Most of those appearing from September to December came from the north-east and departed to the south-east. The egg-pods of the locusts were occasionally parasitised by *Stomatorrhina lunata*, F., and a predacious larva, probably a third instar larva of a species of Meloid, fed on the egg-masses. The false codling moth [*Argyroploce leucotreta*, Meyr.] [*cf.* **23** 409] caused a loss of 0·07 per cent., possibly because the mild winter allowed the moths to remain active. In one or two groves, 2–3 per cent. of the crop was lost owing to the Mediterranean fruit-fly [*Ceratitis capitata*, Wied.].

JONES (E. P.). **The Control of Citrus Thrips, *Scirtothrips aurantii*, Faure, in Southern Rhodesia.**—*Publ. Brit. S. Afr. Co.* no. 4 pp. 11–20, 6 refs. London, 1936.

In Southern Rhodesia, *Scirtothrips aurantii*, Faure, has been successfully controlled on *Citrus* since 1930 by two applications of lime-sulphur at an interval of 10 days [*cf. R.A.E.*, A **18** 633]. Field experiments carried out at the Mazoe Experiment Station from 1931 to 1933 on the use of a single spray of lime-sulphur containing colloidal or wettable sulphur proved indecisive owing to the slight infestation by thrips. Laboratory experiments were therefore undertaken in 1934 to supplement these tests by comparing the amounts of sulphur adhering to the foliage of trees treated with various spray mixtures. Two lots of quantitative determinations were made, the first the day immediately following the application of the sprays, and the second a fortnight later,

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that is 3–4 days after the second spray of 1 per cent. lime-sulphur had been applied in the normal treatment. Trees were sprayed with the following mixtures : 1 gal. lime-sulphur in 100 gals. water, alone, with $\frac{1}{4}$ gal. colloidal sulphur, with 5 lb. wettable sulphur, and with 3 lb. wettable sulphur ; 8 oz. spreader was added to each spray. The lime-sulphur alone was applied twice and the other sprays once. Leaves were picked from these trees and from an unsprayed tree as control. Disks were cut from each leaf, five of a diameter of 21 mm., and one of 7 mm. from the tip (because of the tendency of the spray to collect more at this point). Each sample consisted of 250 large and 50 small disks, and the amount of sulphur on it was estimated analytically. The quantity of sulphur remaining on the day following the first application of lime-sulphur only and of lime-sulphur with colloidal sulphur were 11·72 and 22·04 mg. respectively (average of 8 samples), and a fortnight later (3–4 days after the 2nd application of lime-sulphur only) 12·89 and 11·11 mg. respectively. Results with lime-sulphur and wettable sulphur were inconsistent ; possibly the wettable sulphur does not mix so well with the lime-sulphur as does the colloidal sulphur, the larger particles of the former tending to collect into small lumps. The single spray with colloidal sulphur and lime-sulphur therefore compares favourably with the double application of lime-sulphur.

Tests were also made on the effects on the sulphur residue of different amounts of spreader in the spray solution. Trees were sprayed with 1 per cent. lime-sulphur containing 8 oz. and 24 oz. spreader, and the average amount of sulphur deposited in the latter case was only about 60 per cent. of that in the former case.

Jones (E. P.). **Investigations on the Cotton Boll Worm,** *Heliothis obsoleta*, **Fabr.**—*Publ. Brit. S. Afr. Co.* no. 4 pp. 21–82, 2 pls., 18 refs. London, 1936.

Following severe attacks of *Heliothis armigera*, Hb. (*obsoleta*, F.) on *Citrus* in Southern Rhodesia in 1932, field and laboratory investigations on its bionomics were carried out during 1934. All stages of the moth are described, and the economic importance of the damage discussed. The life-cycle on *Citrus* occupies 41–57 days. Infestation was negligible in 1933, but became severe again in 1934. Oviposition, which generally lasts from late August to late September, with the peak in the first week in September, depends on the time of emergence and duration of flight of the moths, and on the flowering stage of the *Citrus*. Feeding is an essential preliminary to pairing and oviposition ; the apparent olfactory stimulus of flowers is probably only indirectly connected with oviposition, scent being associated with the presence of food. The average longevity of the adults in captivity was 11·4 days for the females, and 8·1 for the males. Eggs are laid on the buds, blossoms and young leaves, and more on the upper parts of the tree than the lower ; on two trees, 1,050 and 302 eggs were collected from the top and 745 and 191 respectively from the lower branches, a difference too great to be attributed to the variation in density of the blossoms. The maximum number of eggs laid by a female in captivity was 1,729, and its ovaries contained nearly 300 mature eggs at death. The average number of eggs laid in a night varied from 30 to 276. The larvae are active from late August to mid-October, attacking the young fruit and blossoms. The younger instars especially often bore into the unopened flower buds and feed on them from within, where they are protected

from sprays or dusts. The older larvae wander about when feeding, but rarely migrate to another tree or to weeds. The egg stage lasted 4·5–6·5 days, the larval 23·5–32·5, and the pupal (in the soil) 13–18.

Infestation on *Citrus* lasts at most 2 months, and comprises the generation produced by the moths from a certain proportion of the overwintering pupae. Further observations were made on the life-history during the rest of the year, from October to the following May, when the larvae occur on maize (particularly in February and March), tobacco, vegetables and other plants. The durations of all stages are given for the different months ; the egg, larval and pupal stages varied from 2·75, 17·8 and 14·1 days respectively in November to 8·85, 51·2 and 56·8 in winter, while the overwintering pupal stage lasted from 73–146 days for pupae formed in May to 139–198 days for those formed in March. There appear to be at least four generations during the summer, and additional small flights of moths occur during the winter. There is evidence that heavy infestation of *Citrus* follows abnormal conditions of temperature or moisture during the winter ; it depends, not only on the number of overwintering pupae, but also on the proportion of them that give rise to moths in August and early September.

Although two parasites, *Trichogramma luteum*, Gir., and *Phanurus* sp., attacked the eggs during the summer, no parasitism of the eggs has been observed in the spring on *Citrus*. Cultural methods of control will have little effect in *Citrus* groves, as the majority of the moths come from lands carrying other crops. The production by irrigation of early blossoming periods, starting before the moths emerge in the spring, would enable the trees to escape heavy infestation, but would at present be impracticable. Hand picking is advantageous when the outbreak is mild and is useful in determining the areas of attack. Unsuccessful experiments with ovicides and larvicides are described in some detail.

Isaakidès (C. A.). **Des insectes et autres animaux nuisibles aux plantes cultivées et des insectes auxiliaires de la Grèce.**—*Ann. Inst. phytopath. Benaki* **1** fasc. 2 pp. 1–12. Athens, 1935. [Recd. July 1936.]

This is a list of pests of cultivated plants, together with some predacious insects and parasitic Hymenoptera, compiled from material examined at the Benaki Phytopathological Institute from 1931 to 1934. It includes 3 mites and 210 insects, and shows in most cases their food-plants or insect hosts and local distribution.

Isaakidès (C. A.). **Le pouvoir attractif de quelques appâts pour la mouche des fruits.** [*In Greek.*]—*Ann. Inst. phytopath. Benaki* **1** fasc. 3 pp. 33–37. Athens, 1935. (With a Summary in French.) [Recd. July 1936.]

Ceratitis capitata, Wied., does extensive damage in many fruit-growing areas of Greece, particularly in the Peloponnesus, and in some cases reduces the crop by over 50 per cent. A measure enforced in some villages consists of suspending in the trees bundles of branches dipped in a solution of 5 parts sodium arsenite, 200 parts sugar-cane molasses, and 800 parts water, and spraying the bundles every week. Since this method has not always given satisfactory results, experiments on the attractiveness of different baits were carried out on peaches.

The mixtures tested included the bait of molasses, an infusion prepared by steeping 8 parts bran in 100 parts water for 24 hours, a 5 per cent. solution of ammonia, and a solution of Clensel (1 : 30). Each bait was placed in 10 glass traps, which were hung on every fourth tree in such a manner that each bait was well distributed throughout the orchards. The trapped insects were counted when the baits were renewed, that is every 4 days for the bait of molasses, every 3 days for the ammonia and Clensel baits, and every 2 days for the bran bait. Clensel was considerably the most effective bait, catching 8,187 fruit-flies in 6 days, while the molasses, bran and ammonia baits caught 113 in 8 days, 552 in 8 days, and 222 in 6 days, respectively.

NAJJAR (Halim). **The Melon Fruit Fly** (*Myiopardalis pardalina*, **Big.**). [*In Arabic.*]—*Circ. Inst. rur. Life Nr East Fdn Amer. Univ. Beirut* no. 8 10 pp., 1 fig. Beirut, Syria, June 1936. (With a Summary in English.)

Myiopardalis pardalina, Big., is a serious pest of melons in Syria, successive generations overlapping from mid-June to late October. The larvae make tunnels through the fruit, which arrest development but do not cause decay or rot. Pupation usually takes place in the soil, but also within the fruit, in which case the emerging adult does not escape until it is broken open. Good results in control have been obtained with a mixture of 4 oz. lead arsenate, 4 lb. sugar and 3·6 gals. water, sprinkled on alternate rows of melon plants at weekly intervals from the time that the first flowers appear. The same mixture, with sodium arsenate substituted for lead arsenate, can be used as a bait in tins at the rate of 40 per acre. The tins are refilled as the liquid dries ; after 2 or 3 fillings water alone is added. All infested fruits should be removed and buried deeply.

WEIDNER (H.). **Der Hausbock** [*Hylotrupes bajulus*, L.].—*Z. PflKrankh.* **46** no. 7 pp. 305–326, 20 figs., 6 pp. refs. Stuttgart, 1936.

Since the promulgation in 1935 and 1936 of laws against *Hylotrupes bajulus*, L., by the Free States of Hamburg and Lübeck, closer attention to it has been paid. No comprehensive paper on this Cerambycid is available, but many short papers have been published in recent years, so that it is possible to present fairly accurate data regarding the chief features of its bionomics.

In this paper notes on its classification and world distribution are followed by a description of the morphology and biology in all stages. The adults pair shortly after emergence and oviposit after maturation feeding, the average number of eggs per female being supposed to be over 100. In captivity the eggs are laid in rather large batches. Incubation depends on temperature and takes 6–19 days in summer. The larvae crawl about before boring into the timber. It is remarkable that adults have emerged in different years, though the larvae belonged to one batch of eggs and had developed in the same beam. The larvae take advantage of cracks, etc., when boring into timber, and usually work inside it without coming to the surface. A few cases where they have mined out of the wood are described. The bore-holes are oval, $\frac{1}{4} \times \frac{3}{4}$ mm. The feeding of the larvae in the wood is described in detail. They usually bore in the sapwood of conifers, and old records of infestation of the wood of other trees have not been confirmed of recent years.

When mature, the larvae bore to a point just beneath the surface and then turn back and pupate at some depth. Pupation usually occurs in May, but sometimes in autumn or winter. After a pupal period of about 3 weeks, the adults emerge, and break or gnaw through the thin surface layer left by the larvae. They have been observed to gnaw through thin zinc or lead. The chief emergence occurs from June to August and the males appear before the females. In warm attics emergence may occur in spring and even in winter.

KAUFMANN (O.). **Eine gefährliche Viruskrankheit an Rübsen, Raps und Kohlrüben.** [A dangerous Virus Disease in Rape and Swedes.]—*Arb. biol. Reichsanst. Berl.* **21** no. 4 (1935) pp. 605–623, 10 figs. Berlin, 1936.

The literature on virus diseases in crucifers is briefly surveyed. The investigations reported here were undertaken on a disease of rape and swedes discovered in an experimental plot at Kiel. In one variety of rape the symptoms were twisting and crinkling of the young leaves and premature dying of the old leaves and of many plants before or during the winter. In diseased plants that survived the winter, retardation or inhibition of growth occurred in spring and summer. Swedes and another variety of rape are attacked to a less intensive and extensive degree. There is no twisting of the leaves, but mosaic marking and a crinkling of the leaf-surfaces with fissures at the edges are particularly noticeable. The plants are often crippled but only rarely killed. Artificial inoculation was easily successful with both forms of rape and with swedes, proving that one virus was concerned, but it failed with other crucifers. *Lygus pratensis*, L., collected on diseased rape, readily transmitted the virus to healthy rape and swedes and was found to live and oviposit on these plants.

Most of the rape plants acquire the infection in summer and autumn, while swedes become infected in spring and maintain the virus until autumn. Even in the absence of swedes, *L. pratensis* can retain the virus during the interval between the death of the old plants and the sprouting of the new ones.

Up to the present serious injury has been done only to individual plants, and the economic importance of the disease lies in the danger connected with its further spread. Practical losses on a large scale have occurred hitherto with swedes only.

PARK (T.). **Studies in Population Physiology. VI. The Effect of differentially Conditioned Flour upon the Fecundity and Fertility of *Tribolium confusum* Duval.**—*J. exp. Zool.* **73** no. 3 pp. 393–404, 2 graphs, 18 refs. Philadelphia, Pa, 5th July 1936.

In continuation of investigations [*R.A.E.*, A **23** 278; **24** 272, etc.] on the effect of various factors on population in *Tribolium confusum*, Duv., experiments were carried out that emphasised the relation of fecundity to flour in intermediate stages of conditioning. A flour medium containing 25 per cent. conditioned flour was sufficiently altered to lower oviposition significantly below the level of a fresh flour control, but there was no appreciable difference in fecundity in an environment of 25 per cent. conditioned flour and in one of 50 per cent. In 75 per cent. conditioned flour, however, considerably fewer eggs

were produced. The lowest egg production occurred in completely or in 75 per cent. conditioned flour. No distinct effects of conditioning on fertility could be demonstrated. These data suggest that self-conditioning of the environment by the beetles is a factor that contributes to the decline of their populations considerably before the culture has reached a decadent state.

FLANDERS (S. E.). **Sexual Dimorphism of Hymenopterous Eggs and Larvae.**—*Science* **84** no. 2169, p. 85. New York, 24th July 1936.

Recent studies on *Coccophagus lycimnia*, Wlk., a parasite of Lecaniine Coccids, showed that the eggs that produce males differ when they are deposited from those that produce females. The female egg is of the usual elongate type, but the male is ovate with a pedicel at one end. In the first and second larval instars also many species of *Coccophagus* and related genera exhibit striking sexually dimorphic characters [*cf. R.A.E.*, A **24** 494, 546].

KING (K. M.). **The Red Turnip Beetle** (*Entomoscelis adonidis* **Pallas).** —*Saskatoon Leafl. ent. Br. Canada Dep. Agric.* no. 45, 1 p. multigraph. Ottawa, June 1936.

Larvae and adults of the Chrysomelid, *Entomoscelis adonidis*, Pallas, outbreaks of which occur in the park-belt and the adjacent margin of the prairie in Canada, feed almost exclusively on crucifers and cause serious damage to crops of turnips, radish and cabbage. There is only one generation a year. The adults appear in early June and are present throughout the summer. Large numbers of eggs are laid in loose masses on small objects on the surface of the soil or in cracks near the food-plants. The larvae hatch early in the spring and feed (mostly at night) on cruciferous weeds, and later on garden plants. They pupate in the soil at a depth of about an inch. The best control is given by clean cultivation of the garden and surroundings to eliminate weeds, particularly in the early spring before the susceptible plants are put in, and during July and August when oviposition occurs. Autumn ploughing to cover the eggs is said to be effective, and both adults and larvae are easily killed by sprays or dusts of Paris green or calcium arsenate. For dusting Paris green should be mixed at the rate of 1 : 15–20 and calcium arsenate at 1 : 10–12 with a carrier, such as slaked lime, cheap flour or road dust. Where the beetles migrate from weedy fields, the weeds should be dusted for some distance round the garden. Poisoned bran bait, applied thinly over the infested area, is also reported to be effective.

GILLIATT (F. C.). **Observations on the Mealy Bug,** *Phenacoccus aceris* **Sig.**—*Canad. Ent.* **68** no. 6 p. 133. Orillia, June 1936.

Further observations on the life-history of *Phenacoccus aceris*, Sign., on apple in Nova Scotia [*cf. R.A.E.*, A **23** 680] showed that the female nymphs emerge from the winter cocoons and spread over the tree to feed earlier than had been supposed. In 1935, 4–5 per cent. of the total number were already feeding by 20th March, although the temperature was below freezing point in the shade. In mid-May the females migrated back to their winter hibernating quarters on the trunk and large branches in order to pair with the emerging males, afterwards

dispersing over the tree to resume feeding. In 1936 the first female nymphs emerged from hibernation on 11th March, at the beginning of a period of mild weather.

McLaine (L. S.). **A new Phase of Insect Distribution by Means of Flood Waters.**—*Canad. Ent.* **68** no. 6 p. 141. Orillia, June 1936.

Freight cars moved into Canada from recently flooded areas in Pennsylvania contained up to 1,000 lb. soil in a layer 4–8 ins. deep on the floor. The soil was examined, as the cars came from a district infested with the Japanese beetle [*Popillia japonica*, Newm.], but no larvae of this beetle were found, although those of other insects were collected. Instructions were given that all such cars must be cleaned before entering Canada.

Cartwright (W. B.) & Wiebe (G. A.). **Inheritance of Resistance to the Hessian Fly in the Wheat Crosses Dawson × Poso and Dawson × Big Club.**—*J. agric. Res.* **52** no. 9 pp. 691–695, 1 fig., 3 refs. Washington, D.C., 1936.

Experiments have been carried out since 1932 in California with a view to breeding a variety of wheat resistant to attack by *Mayetiola* (*Phytophaga*) *destructor*, Say. On resistant plants the life-cycle [*cf. R.A.E.*, A **17** 162] is not completed, the larvae dying shortly after reaching the feeding position. Selections from the variety Dawson were shown to be highly resistant to attack by *M. destructor*, and the varieties Poso and Big Club very susceptible under Californian conditions. The crosses Dawson × Poso and Dawson × Big Club showed inheritance of resistance in the F_2 generation when classified on their behaviour in F_3 rows, in a ratio closely approximating to the theoretical 15 : 1 ratio occurring when two factors are involved. The data indicate that resistance in the Dawson variety is heritable and that it is controlled by two genetic factors.

Pyenson (L.) & MacLeod (G. F.). **The Toxic Effects of Naphthalene on *Bruchus obtectus* and *Tenebrio molitor* in various States of Development.**—*J. agric. Res.* **52** no. 9 pp. 705–713, 2 figs., 11 refs. Washington, D.C., 1936.

In these experiments on the toxicity of naphthalene to the various stages of *Bruchus obtectus*, Say, and *Tenebrio molitor*, L., a modification of Lehman's apparatus [*R.A.E.*, A **19** 212] was used in a room with a constant temperature of 25°C. [77°F.]. All stages of the insects were exposed for the required time to a stream of air saturated with naphthalene, or in the case of the controls, to air only. Before and after treatment they were kept at 25°C. [77°F.] and a relative humidity of approximately 60 per cent.

Eggs of *B. obtectus* that were not more than 1 day old were exposed for periods varying from 1 to 6 hours. The percentages hatching were 45, 6 and 0·4 after exposure for 3, 5 and 6 hours, respectively. Of the eggs of *T. molitor* 48, 8 and 1 per cent. hatched after exposures of $1\frac{1}{2}$, $2\frac{1}{2}$ and 3 hours. In the control batches, 91–96 and 89–91 per cent. respectively of the eggs of the two insects hatched. During their development the eggs used in the experiments lost weight continuously, presumably in the form of water and carbon dioxide ; since these are the end products of respiratory metabolism, the author believes that the percentage daily loss in weight of the eggs provides a relative

measure of the rate of respiratory metabolism. There was a definite relation between loss in weight of the eggs and the lethal effects of the naphthalene, a greater loss being associated with increased mortality. The percentage of Bruchid eggs killed after exposure for 3 hours increased with age until the eggs were 4–5 days old, when the mortality was 90 per cent., after which it decreased until the eggs were ready to hatch (6–7 days old) when 22 per cent. were killed. At the same time the daily loss in weight of untreated eggs increased from 2·72 per cent. at 1 day old to 4·56 per cent. at 4–5 days old and decreased to 3·48 per cent. at 5–6 days old. With similarly treated eggs of *Tenebrio*, on the other hand, mortality was highest (99 per cent.) in those 1 day old, decreased with age to a minimum (10 per cent.) in those 4–5 days old, and then increased slightly (to 23 per cent.) in eggs 7–8 days old just before hatching ; no newly hatched larvae were killed by this exposure. The percentage daily losses in weight of untreated eggs of the same ages were 7·83, 1·18 and 2·04. In sublethal dosages, naphthalene vapour retarded the development of the Bruchid eggs, the greatest delay (1·3–1·8 days) occurring in eggs treated when 3–4 days old. The surviving larvae were apparently uninjured. The incubation period of the eggs of *Tenebrio* was not significantly affected by this treatment.

Sublethal exposures of larvae of *Tenebrio* did not affect subsequent growth as measured by gain in weight. The mortality after exposures of 16 hours decreased in general with increasing age and weight. Larvae weighing 0·47 mg. and 2 days old were all killed, but only 4 per cent. of those weighing 36·00 mg. and 4 months old. An exposure of 24 hours killed 20 per cent. of full-grown larvae, 38–86·6 per cent. of pupae (varying with age), and 100 per cent. of adults. The stages that lost the greatest weight in 24 hours were most susceptible to naphthalene. Pupae and prepupae that survived but developed into abnormal adults were counted as dead. Adults emerging from the pupae subjected to sublethal exposures produced eggs that were not significantly different in number or fertility from the controls. Treatment for 6 hours of the adults had no effect on the fertility of the eggs that the survivors laid, but they only produced an average of 1·8 eggs each per day compared with 5·4 eggs laid by control insects. In a comparative test with adult insects of 6 species and with woodlice and millepedes, Diptera were the most susceptible and Coleoptera the most resistant, exposures of less than 2 and over 40 hours being required to effect 100 per cent. mortality of *Muscina stabulans*, Fall., and *B. obtectus*, respectively.

In further experiments, naphthalene dissolved in olive oil or olive oil alone was injected between the 4th and 5th abdominal segments into pupae of *Tenebrio* up to 2 days old. Both the total percentage of pupae killed and the speed of kill increased with the concentration of the naphthalene. The naphthalene vapour must be absorbed by the body tissues to be effective, and acts slowly on these pupae. The fat-bodies were probably the first tissues to be affected, since they seemed to be partly disintegrated and discoloured in treated larvae and pupae.

RITCHER (P. O.). **Host Relationships of the Larger Apple Curculio, *Tachypterellus quadrigibbus magnus* List.**—*J. Kans. ent. Soc.* **9** no. 3 pp. 94–99, 4 refs. McPherson, Kans., July 1936.

The author presents evidence that variations in adult size within the subspecies *Tachypterellus quadrigibbus magnus*, List [*R.A.E.*, A **20**

703] as it occurs on apple and wild food-plants in south-western Wisconsin are correlated with the plants on which it develops and do not indicate the existence of separate subspecies. The principal wild food-plant in western Wisconsin is *Crataegus*. A table shows that in both sexes, the body length of adults reared from *Crataegus* in mid-summer, shortly after the new generation begins to emerge, is nearly always less than that of those reared on or taken from apples at the same time, overlapping being very slight. This was also true in general for collections during the spring feeding and egg-laying period, but the body length of about 10 per cent. of the weevils on each food-plant was that characteristic of the weevils on the other one. It would appear that this represents the percentage of transfer, and that since there was crossover in both directions, removal of wild food-plants would be of little or no value [*cf.* **24** 600], especially as the *Crataegus* population serves as a breeding ground for parasites. The known sluggishness of the weevils and the fact that they prefer to feed and oviposit on the fruits of the species from which they had been reared, as was demonstrated by experiments the results of which are given in tables, appear to contribute to the low percentage of transfer. Since this pest is a native insect that has come to apple from wild food-plants within the last century, and small adults, morphologically identical with the usual *Crataegus* population, were readily produced in *Crataegus* from eggs laid by large ones reared from apple, it would seem that the size depends on the amount of food available on the two food-plants.

Hildebrand (E. M.) & Phillips (E. F.). **The Honeybee and the Beehive in Relation to Fire Blight.**—*J. agric. Res.* **52** no. 10 pp. 789–810, 2 figs., 21 refs. Washington, D.C., 1936.

A detailed account is given of four years' studies in the United States to determine the rôle of the honey-bee and bee-hive in the development of fire blight. The results indicate that *Bacillus* (*Erwinia*) *amylovorus* in incapable of overwintering in the hive or in association with the bee, which cannot, therefore, constitute a source of primary inoculum in the spring. When introduced through the food of the bees, the bacteria were not re-isolated after 3 days from honey, comb, frame or bees. In only two instances were they recovered after more than 3 days (from pollen after 13 days and from frame scrapings after 12). Data on their longevity in sugar solutions render it highly improbable that they can survive in the hive at the temperatures and sugar concentrations normally encountered. They were not found associated with the immature stages of the bee, even though abundant in the food of the bees during the rearing of the brood. The bee was found to function in two ways, namely, in carrying the bacteria from the hive to the flowers, and in disseminating them from flower to flower. Transfer of inoculum from the hive to flowers depended, however, on the bees actively feeding on contaminated food.

Decker (G. C.). **The Parasites of some Lepidopterous Stalk Borers in Iowa.**—*Iowa St. Coll. J. Sci.* **9** no. 4 pp. 567–580, 29 refs. Ames, Iowa, April 1935. [Recd. June 1936.]

Observations made in the course of 6 years in Iowa are recorded on the parasites of the Noctuids, *Achatodes zeae*, Harr., *Luperina stipata*, Morr., *Macronoctua onusta*, Grote, *Papaipema nebris*, Gn., *P. cataphracta*, Grote, *P. arctivorens*, Hmps., *P. purpurifascia*, Grote & Rob.,

P. frigida, Smith, *Oligia fractilinea*, Grote, and *Archanara subcarnea*, Kell., and the Tortricids, *Epiblema otiosana*, Clem., and *E. strenuana*, Wlk. Some of these stalk-borers attack only weeds, but are of importance because they serve as reservoirs or alternate hosts of parasites of injurious insects. A list is also given of parasites of these borers recorded by other workers, but not encountered in the course of the investigation.

The following is taken from the author's discussion and summary: The host species studied are attacked by many parasites, including those of unrelated species having similar feeding habits as well as those of closely related species having very dissimilar habits. Thus *E. otiosana* and *E. strenuana* are attacked not only by species such as *Pimpla* (*Epiurus*) *pterophori*, Ashm., *Microdus* (*Bassus*) *simillimus*, Cress., and *Microbracon caulicola*, Gah., which use other stalk-borers as hosts, but also by *Lixophaga variabilis*, Coq., and *Macrocentrus delicatus*, Cress., which are parasites of *Cydia* (*Laspeyresia*) *molesta*, Busck, *C.* (*Carpocapsa*) *pomonella*, L., and other fruit-infesting insects. Similarly the Noctuid borers studied are attacked by *Ceromasia* (*Masicera*) *senilis*, Mg., *Microplitis gortynae*, Riley, and *P. pterophori*, which largely parasitise stalk-boring insects, and also by *Winthemia rufopicta*, Big., *Meteorus vulgaris*, Cress., *Apanteles militaris*, Walsh, and others which are well-known parasites of external-feeding Noctuids, such as cutworms and armyworms.

Papaipema spp. and other Noctuids, when exposed during periods of migration, are readily attacked by cutworm parasites, which would not attack them in their burrows. *Luperina stipata*, which works upwards from the base of the plant and spends much of its life below the soil surface, is highly parasitised by *Meteorus vulgaris* and *Apanteles laeviceps*, Ashm., two common parasites of cutworms, and *Oligia fractilinea*, which feeds in the open heart of the maize plant, is attacked by 4 parasites of armyworms. The presence of excreta near the burrows of the borers attracts several omnivorous flies of the genera *Sarcophaga* and *Muscina*, which at times assume a parasitic habit.

Factors influencing the intensity of parasitism are discussed. Where the host has only one generation a year and the parasite more, the necessity of an alternate host decentralises the parasite population by scattering it over large areas and into different ecological habitats. Mowing of infested plants or other conditions producing borer migration increases the probability of attack by cutworm parasites. Hyperparasites, particularly *Eupteromalus viridescens*, Walsh, in Hymenopterous pupae and *E. dubius*, Ashm., in Dipterous puparia, greatly reduce the incidence of parasitism by primary parasites. Not many of the parasites, most of which are then below the soil surface, are destroyed by the burning of fence-rows and grasslands during winter for the control of overwintering eggs of Noctuids. Even those hibernating in the plants are not all destroyed, as a rapid fire leaves the larger stalks charred only on the outside. Live pupae of *Gymnochaeta ruficornis*, Will., *Lissonota brunnea*, Cress., and *Microplitis gortynae* have been taken from stumps of ragweed after a fire had burned over the area.

British Guiana. Plant Diseases and Pests (Prevention) Ordinance No. 37 of 1935.—8 pp. Georgetown, 24th December 1935. [Recd. July 1936.]

This Ordinance provides for the regulation by the Governor in Council of the import and export of plants in British Guiana, for the

enforcement of quarantine of nurseries, for the declaration of infested areas in any part of the Colony, for the notification of pests or diseases, and for the enforcement of measures for their eradication.

British Guiana. Orders in Council under the Plant Diseases and Pests (Prevention) Ordinance 1935.—Nos. 551, 1 p.; 552, 3 pp. Georgetown, 2nd April 1936.

The first of these Orders prohibits the import into British Guiana of sugar-cane, grasses, any kind of earth and soil, including wrappings or cases that have contained earth or soil, and banana and plantain suckers without authorisation of the Director of Agriculture. The second prescribes the conditions of inspection and certification under which other plants and plant parts may be exported from or imported into the Colony.

British Guiana. Order in Council under the Plant Diseases and Pests (Notification) Regulations, 1936.—No. 550, 1 p. Georgetown, 2nd April 1936.

Brassolis sophorae, L. (coconut caterpillar) is declared a notifiable pest in British Guiana.

Barradas (H.). **Uma lagarta do tabaco.** [A Lepidopterous Pest of Tobacco.]—*O Campo* **7** no. 77 p. 30, 1 fig. Rio de Janeiro, May 1936.

In some parts of the State of Rio de Janeiro the Sphingid, *Protoparce sexta*, Joh. (*carolina*, L.), is a serious pest of tobacco, on which the larvae occur from April to September, appearing soon after the seedlings have been transplanted. An arsenical dust may be used until the plants are half-grown, but not later. The larvae are destroyed by poultry and other birds, and are parasitised by *Apanteles congregatus*, Say, and the Tachinid, *Belvosia bifasciata*, F.

Azzi (R.). **Inimigos do fumo.** [Tobacco Pests.]—*Bol. Agric. S. Paulo* **36** (1935) pp. 375–394, 15 figs. S. Paulo, 1936.

This first part of a paper on tobacco pests in Brazil comprises a list of the pests, most of which are insects, with brief notes on the bionomics and control of the Coleoptera and some of the Lepidoptera.

Hayward (K.). **La cochinilla blanca de los citrus y su control.** [The Citrus White Scale, *Prontaspis citri*, and its Control.]—*Circ. Estac. exper. Concordia* no. 9, 4 pp. multigraph. Concordia, March 1936.

Prontaspis citri, Comst., is the most serious pest of *Citrus* in Concordia, Argentina, infesting all the trees in some groves and being capable, like *Lepidosaphes beckii*, Newm., another common species there, of killing even large trees in a short time. In years with a mild winter there may be 4 generations. For severe attacks, a spray of white oil emulsion should be applied to the trunk and main branches at a concentration of 2–2·5 per cent. and again 15–20 days later to the whole tree at a concentration of 1·7 per cent. Alternatively, the whole tree may be sprayed twice with the weaker emulsion, or once only if infestation is slight.

Weddell (J. A.). **A recent Army Worm Outbreak.**—*Qd agric. J.* **45** pt. 5 pp. 449–460, 11 figs., 1 ref. Brisbane, 1st May 1936.

Serious damage to fodder crops and pasture in widely separated districts of Queensland was caused in March 1936 by *Laphygma* (*Spodoptera*) *exempta*, Wlk. [*cf. R.A.E.*, A **21** 406]. The outbreak followed one of *Nysius vinitor*, Bergr. (Rutherglen bug) on market garden crops and one of *Monolepta rosea*, Blkb. (red-shouldered leaf beetle) on maize, figs, cotton, etc. Wheat, maize and almost all the other graminaceous fodder crops were severely damaged, particularly when the plants were 6–12 inches high, in which case the fields were denuded at the rate of more than an acre a day. Young growth was preferred, and the caterpillars moved more slowly over older plants owing to the greater quantity of food they provided. Leguminous plants were quite unharmed, the passage of the larvae through them ensuring a clean crop. The infestation quickly spread to grazing land ; in one area 2,000 acres of *Paspalum*, 3 inches high, were eaten bare, but most weeds except *Cyperus rotundus* were left. Where the growth was short, the caterpillars moved forward in a definite line, 12–18 ins. wide and, on small farms, 100–200 yards long. Sometimes several lines coalesced and extended a mile or more. One line was observed to move forward 20 ft. overnight. Some of the larvae (about 10 per sq. yard) remained behind, and these immediately destroyed any new growth, and complicated control. The life-cycle appeared to be 50 per cent. longer than that of *Spodoptera mauritia*, Boisd., as noted by Smith [**21** 406], but this is probably due more to difference of temperature than to specific differences. The larval stage lasted 3 weeks and the pupal 10 days. Pupation appeared to take place invariably in the soil.

Poultry and other birds, of which ibis were the most effective, destroyed large numbers of the larvae, but the control so afforded was of no practical significance. Towards the end of the outbreak generation of caterpillars, parasites, including a Braconid of the genus *Apanteles*, the Ichneumonid, *Lissopimpla semipunctata*, Kby., and a Tachinid, were seen to be active.

The most satisfactory and economical control was afforded by a poison bran bait, made by mixing 1 lb. Paris green with 25 lb. bran and adding 1 qt. molasses in 7 qts. water. The bait remains moist and attractive longer if the quantity of molasses is doubled. When possible it should be applied in the late afternoon ; where this is impossible, or when the weather is very dry, the total fluid should be increased to 2½ gals. A strip of bait 6–8 ft. wide was broadcast so that half lay in front of the line of caterpillars and the remainder over and behind them. The quantities of material given are sufficient for a line ⅓ mile long and cost 5–6*s*. The bait can be made more effective by scattering it thinly in a furrow a few feet in front of the line. It stopped the caterpillars in low growing crops, but among tall or rank plants gave less good control, unless applied on a bared area made by mowing a strip in front of the line. A spray of 10 per cent. crude oil emulsion was found to destroy a high percentage of the caterpillars receiving it, but to kill the parts of the plants with which it came in contact. The results obtained with a flame thrower were slow, the larvae being protected by the moisture in the foliage. Mechanical methods of control killed large numbers, but did not check the advance of the line.

CUTHBERTSON (A.). **Biological Notes on some Diptera of Southern Rhodesia.**—*Occ. Pap. Rhod. Mus.* no. 5 pp. 46–63. Bulawayo, May 1936.

The species dealt with include: the Phorid, *Pulicophora rhodesiana*, Schmitz, bred from egg-pods of the red locust [*Nomadacris septemfasciata*, Serv.]; the Chloropids, *Anatrichus erinaceus*, Lw., from stems of *Eleusine coracana*, and *Scoliophthalmus obliquus*, Beck., from stems of "Wintersome," a fodder crop allied to *Sorghum*; and the Tachinids, *Alophora nigeriensis*, Villen., which parasitises the cotton stainers, *Dysdercus fasciatus*, Sign., *D. intermedius*, Dist., and *D. superstitiosus*, F., *Bogosiella fasciata*, F. (of which *B. pomeroyi*, Villen. [*cf. R.A.E.*, A **21** 485] is a synonym) bred from *D. superstitiosus*, and *Zenillia* (*Carcelia*) *evolans*, Wied., an important parasite of the overwintering brood of *Busseola fusca*, Fuller, on maize. Parasitism of the stainers by the first two Tachinids, which are only known in the centre of Southern Rhodesia, amounted to 1·6 per cent. in 1934. *Z. evolans* was parasitised by *Perilampus maurus*, Wlk.

BOUHELIER (R.). **Observations sur la lutte contre la cératite.**—*Rev. maroc. Fruits Prim. Afr. N.* **6** no. 64 pp. 162–165. Casablanca, May 1936.

The author draws general conclusions from the results of experiments on the trapping of *Ceratitis capitata*, Wied., and from observations made in Morocco over 5 years. Weekly records were taken in three types of orchards, planted exclusively with deciduous fruit-trees, with *Citrus*, or with both. In all, the flies first appear in June, but in the deciduous orchards they are most abundant in July and August, during the ripening period of the fruit, and their numbers diminish until November, after which they are not observed. In the citrus groves they reach maximum abundance in October and November and disappear during February. In the mixed orchards they are abundant in July and August and again in October and November, and disappear in January. There appears to be no fixed relation between the state of development of the fruit and the abundance of the flies; in the orange groves the important flights preceded the heaviest attack on the fruit. In any orchard abundance may possibly be accounted for in two ways: by multiplication in the fruit, or by delayed and gradual emergence from the pupae during a period of $1\frac{1}{2}$–4 months from the beginning of June. Multiplication could not occur unnoticed as the traps definitely indicated the periods of maximum flight. Adults emerging in June from the pupae formed late in the preceding season would reproduce immediately if fruit of acceptable ripeness were present, or might live without reproducing, as do those that emerge later, until *Citrus* or late peach had developed.

Tests made on the value of baits showed that their effect depended on their initial odour, and that after fermentation they ceased to be attractive. In the hot season they ferment more quickly, and the fruit ripe at this time appears more attractive to the flies, which are therefore more indifferent to the baits in the summer than in the autumn. A bait prepared by steeping coarse flour (middlings) and borax in water [*R.A.E.*, A **24** 153] retains its odour for a week, at the end of which rod-shaped bacteria are present in the liquid. A similar bait without the borax smelt disagreeably after 10 hours and putrid after a week,

patches of yeast forming on the surface. From 10 to 20 times as many fruit-flies were caught with the former type of bait than with the latter. One trap with the bait of middlings and borax caught up to 1,410 females and 312 males in a week in a peach orchard and 355 females and 82 males in a citrus grove; the mean weekly catch from stone-fruit trees during the period of greatest abundance exceeded some hundreds, and from orange some dozens. Baits of middlings and borax attracted 5–6 times as many flies as those of bran and borax. In one peach orchard the percentage of infested fruit was reduced from 95 to 5 by trapping and the removal of fallen infested fruit.

MORSTATT (H.). **Kaffee-Schädlinge und -Krankheiten Afrikas. III. Beschädigungen der Blätter.** [Coffee Pests and Diseases in Africa. III. Injuries to the Leaves.]—*Tropenpflanzer* **39** no. 7 pp. 273–299, 15 figs. Berlin, July 1936.

The pests dealt with in this third article of a series [*cf. R.A.E.*, A **24** 376, etc.] include Tetranychid mites, Thysanoptera, Lepidoptera, locusts, and Coleoptera.

ANDRÉ (M.). **Die Milben der menschlichen Wohnungen.** [The Mites found in Human Habitations.]—*Mitt. Ges. Vorratsschutz* **12** nos. 2 & 4 pp. 13–15, 42–49. Berlin, March & July 1936.

This is a survey of the literature on mites found in buildings, including warehouses, barns, etc., as well as dwelling houses.

SPEYER (W.). **Tätigkeitsbericht der Biologischen Reichsanstalt für Land- und Forstwirtschaft, Zweigstelle Stade . . . vom 1. April 1935 bis 31. Marz 1936.** [Report from 1st April 1935 to 31st March 1936 of the Stade Branch of the Imperial Biological Institute for Agriculture and Forestry.]—*Altländer Ztg*, 4th, 11th & 18th April 1936 reprint 5 pp. [Jork] 1936.

The summer of 1935 closed a 10-year period of statistics on *Psylla mali*, Schm., in the orchard districts of the Lower Elbe, and it has already been found that the date of hatching of the larvae can be forecast with fair accuracy. *Lygus pabulinus*, L., did not attack apple only, but also occurred on horse beans together with *Calocoris norvegicus*, Gmel. *Orthotylus marginalis*, Reut., which is commonly regarded as injurious, was found to be beneficial as it feeds chiefly on Aphids [*R.A.E.*, A **24** 486]. Adults from some of the pupae of the cherry fly, *Rhagoletis cerasi*, L., emerged after the pupae had passed two winters in the soil and this was also the case with one of its parasites, *Opius rhagoletieolus*, Sachtleben. This species parasitised the larvae in the fruits of cherry and *Lonicera*, whereas *Phygadeuon wiesmanni*, Sachtleben, attacked them when they were entering the ground to pupate. The woolly apple aphis [*Eriosoma lanigerum*, Hsm.] has increased, and attention was paid to its natural enemies [**23** 705, 717; **24** 290]. Braconids and Chalcids parasitised a high percentage of the larvae of a Syrphid, *Cnemodon fulvimanus*, Zett., hibernating under bark scales of fruit trees. The larvae of this Syrphid appeared to prey on *E. lanigerum*.

Rademacher (B.). **Flissigkeit, Blasenfuss-Schäden und Fritlfliegenbefall an Haferrispen.** [White Ear, Thrips Injury and Frit-fly Infestation in Ears of Oats.]—*Kranke Pflanze* **13** no. 7–8 pp. 129–132. Dresden, 1936.

The differences in the appearance of ears of oats affected by "white ear," those infested by *Oscinella frit*, L., and those infested by thrips (*Stenothrips graminum*, Uzel, and *Limothrips cerealium*, Hal.) are illustrated and described. Though "white ear" can in certain circumstances be caused by thrips, the author considers that it is due chiefly to lack of water and nutriment and, in a less degree, to other causes, such as inadequate aeration of the soil, and cold and sunless weather.

Reichert (A.). *Taeniocampa gothica* **L. an Pflaume.** [*Monima gothica* on Plum.]—*Kranke Pflanze* **13** no. 7–8 pp. 139–140, 1 pl. Dresden, 1936.

The larvae of *Monima* (*Taeniocampa*) *gothica*, L., are recorded as feeding on the leaves of plum in Saxony. The moths appear in March–April, and the egg-stage lasts 14 days. An editorial note states that the larvae have also been recorded in Germany from pear and apple.

Subklew (W.). **Zur Frage der Kornkäferbekämpfung mittels Silobegasung.** [The Control of *Calandra granaria* by Fumigation in Silos.]—*Nachr. SchädlBekämpf.* **11** no. 2 pp. 99–103, 6 figs. Leverkusen, June 1936. (With Summaries in English, French and Spanish.)

A description is given of a modified equipment for using Areginal to fumigate grain infested by *Calandra granaria*, L., in silos in Germany [*cf. R.A.E.*, A **23** 755, etc.]. The air is extracted at the top of the silo, passed through an electric heater and takes up Areginal in finely divided particles that instantly vaporise. It is then blown into the bottom of the silo and passes through the grain to the extraction outlet at the top, so that there is a constant circulation. At any suitable point, a chamber for the disinfestation of sacks can be fitted. A portable fumigator for circulating the vapour in small fumigation chambers is also described. It can be used with any chamber fitted with appropriate connectors for the extraction and blower hose pipes.

Janisch (E.). **Physiologische Grundlagen der Nonnenprognose.** [The physiological Principles of forecasting Abundance of the Nun Moth.]—*Anz. Schädlingsk.* **12** no. 7 pp. 77–82, 5 figs., 6 refs. Berlin, July 1936.

Scientific investigation on insect pests, once prosecuted on systematic, faunistic and ecological lines, is now tending to be based on physiological studies. Laboratory experiments, which were formerly regarded merely as obviating difficult and costly field work, are the chief means for ascertaining the physiological characteristics of a pest that ultimately govern its reactions to conditions in nature. Zwölfer's work on *Lymantria monacha*, L. [*R.A.E.*, A **23** 136] has justified the author's preference for the catenary curve as compared with the hyperbolic curve as a means of representing the influence of temperature on development and the effect of nutrition in modifying it. Examples illustrating these points are given from the author's experiments.

PETERS (G.). **Ein neues Verfahren zur Vakuumentwesung mit giftigen Gasen.** [A new Process for Vacuum Disinfestation with poisonous Gases.]—*Anz. Schädlingsk.* **12** no. 7 pp. 82–88, 8 figs. Berlin, July 1936.

An illustrated description is given of a vacuum fumigation chamber in which the gas is circulated so as to achieve uniform distribution without a serious drop in the vacuum. A further advantage is that the actual evaporation of the liquid fumigant is effected outside the chamber at atmospheric pressure. The chamber is a horizontal cylinder. A pipe parallel to it, communicating near each end and fitted with valves, connects with an air pump, a discharge pipe and a box in which tins of Zyklon B (liquid hydrocyanic acid absorbed in a porous inert carrier) can be placed and pierced. The vacuum having been produced in the chamber by the pump, atmospheric pressure is obtained in the pipe and box by means of the valves. The pump circulates the air through the box and chamber; and as it wo ks at a slight compression, the warmth generated effects a rapid evaporation of the HCN and ensures its complete extraction from the porous carrier. Details are given of the very complete distribution of the gas in both empty and loaded conditions of the chamber.

KÜTHE (K.). **Beobachtungen über das Auftreten der Pflaumensägewespen und des Pflaumenwicklers.** [Observations on the Occurrence of Plum Sawflies and of the Plum Tortricid.]—*Anz. Schädlingsk.* **12** no. 7 p. 88. Berlin, July 1936.

At Landsberg a.d. Warthe, Prussia, adults of *Hoplocampa minuta*, Christ, and *H. flava*, L., were observed from 6th to 18th May. *H. flava* had not previously been recorded from eastern Germany. Of the total crop of plums 14 per cent. were infested by the sawflies and 6 per cent. by *Cydia* (*Grapholitha*) *funebrana*, Treit.

MASERA (E.). **Esperimenti moderni di lotta biologica agli insetti e conoscenze attuali sulle loro malattie batteriche.**—*Annu. Staz. bacol. sper. Padova* **48** pp. 351–359. Florence, 1936. **La lotta biologica agli insetti dannosi con l'impiego di miceti patogeni.**—*T.c.* pp. 361–372. **Un fungo del genere** *Botrytis* **parassita degli insetti.**—*T.c.* pp. 373–380, 5 figs., 4 refs. **La** *Beauveria globulifera* **(Speg.) Picard parassita del** *Bombyx mori* **L.**—*T.c.* pp. 381–397, 9 figs., 26 refs. **Setticemia nelle larve di** *Tenebrio molitor* **L.**—*T.c.* pp. 399–408, 1 fig., 10 refs. **Il** *Bacillus prodigiosus* **Flügge nella patologia del baco da seta** [*B. mori*] **e degli insetti.**—*T.c.* pp. 409–416, 10 refs. **Comportamento del** *Bombyx mori* **L. alla infezione sperimentale del** *Bacterium prodigiosum* **L. et N.**—*T.c.* pp. 417–422, 21 refs. **Fenomeni di antagonismo e antibiosi fra** *Bacillus prodigiosus* **Flügge e** *Beauveria bassiana* **Vuill.**—*T.c.* pp. 423–458, 2 figs., 5 pp. refs. **Flora microbica nelle uova di** *Bombyx mori* **L.**—*T.c.* pp. 459–476, 1 graph., 4 pp. refs. **Contributo allo studio della virulenza e patogenicità di alcuni entomomiceti.**—*T.c.* pp. 477–491, 5 graphs, 14 refs. **Osservazioni sull'infezione da** *Nosema bombycis* **Naegeli nel** *Bombyx mori* **L.**—*T.c.* pp. 493–500.

Four of these papers have already been noticed [*R.A.E.*, A **22** 201, 381, 605; **23** 624].

The first paper is a survey of present knowledge on the utilisation of fungi and bacteria for the control of insect pests. In the fourth paper

an account is given of a natural infection by *Beauveria globulifera* of larvae of *Bombyx mori*, L., being bred at the Padua silkworm experiment station. This is the first record of a natural infection of silkworms by this fungus, and it was probably due to introduced spores, as the fungus was not being studied at the station. The seventh paper deals with the behaviour of *B. mori* when experimentally infected with *Bacillus* (*Bacterium*) *prodigiosus*. It was found in dead larvae and pupae, but not in adults and eggs. The eighth paper describes experiments *in vitro* and *in vivo* with *Beauveria bassiana* and *Bacillus prodigiosus* and phenomena of antagonism between the fungus and the bacillus in *Tenebrio molitor*, L. The bacillus was not pathogenic to this beetle, and when associated with it the fungus caused less mortality than when acting alone. The ninth paper demonstrates the existence of a microbic flora in the eggs of *B. mori*. The tenth paper describes experiments in infecting larvae of *T. molitor* with fungi of the genus *Beauveria*. *B. bassiana* and *B. globurifera* were pathogenic, whereas *B. tenella* was not. Mortality with *B. bassiana* was less when it was associated with *Bacillus prodigiosus*. The eleventh paper records observations on adults of *Bombyx mori* with inherited or acquired infection by *Nosema bombycis*.

[Kozhanchikov (I. V.).] Kožančikov (I. V.). **Insect Metabolism at Temperatures below Zero.**—*C.R. Acad. Sci. URSS* N.S. **3** no. 8 pp. 373–376, 1 fig., 4 refs. Moscow, 1935. [Recd. July 1936.]

Investigations on metabolic processes in insects under the influence of low temperature are important for a clearer understanding of diapause. It has been shown by many workers that the influence of cold on insects in the diapause results in their further development, but it is not clear whether this is due to structural alterations in their tissues or to changed metabolic processes. Since methods commonly used in investigation of metabolism present technical difficulties at low temperatures, the author describes an apparatus by which the amount of oxygen consumed by insects during the period of exposure was determined in his own experiments. It was found that there exists a great constancy in the intensity of oxygen consumption by larvae in diapause. Thus, a larva of *Pyrausta nubilalis*, Hb., weighing 111·6 mg. consumed 10·7 cu. mm. oxygen per hour when exposed at 12°C. [53·6°F.] for 41 hours 35 minutes or for 29 hours; another weighing 98·4 mg. and kept at 0°C. [32°F.] consumed 2·2 and 2·28 cu. mm. oxygen per hour during 35 and 21½ hours respectively. In special tests, the results of which are tabulated, a drop in temperature from 6 to 0°C. [42·8 to 32°F.] caused a decrease of 2·28 times in the oxygen consumption by the larvae of *P. nubilalis* and a further drop from 0 to −6°C. [32 to 21·2°F.] caused a decrease of 1·38 times. Larvae of *Loxostege sticticalis*, L., showed no decrease in oxygen consumption under the influence of temperatures ranging from 0 to −6° C., this difference in the reaction to low temperatures being probably due to the different cold-resistance of the two species.

An investigation on the respiratory quotients showed that at 0°C. they are higher than at 20°C. [68°F.] or −6°C. At 0°C. the larvae of *P. nubilalis* remain in diapause during many months. At 20°C. they pupate after a month or more under conditions of high humidity. Exposure to negative temperatures results in a shorter period of pupation at 20°C.

The metabolism at 0°C. shows the important rôle of carbohydrates ; on the other hand, the quotients at −6° and 20°C. show the prevalent rôle of fats or proteins in the larval metabolism.

Butler (C. G.). **The Occurrence of the Chalcids** *Encarsia partenopea* **Masi and** *E. tricolor* **Förster in England (Hymenoptera).**—*Proc. R. ent. Soc. Lond.* (A) **11** pt. 3–5 pp. 79–80, 6 refs. London, 30th June 1936.

In 1935, large numbers of pupae of *Aleurodes brassicae*, Wlk. (cabbage whitefly) were collected within a thirty-mile radius of Cambridge, and, although most of the material was unparasitised, two Eulophids, *Encarsia partenopea*, Masi, and *E. tricolor*, Förster, were reared, the latter being recorded for the first time in Britain. Characters are given for distinguishing the two parasites, both of which seem able to breed parthenogetically. Many males and a few females of *E. partenopea* were obtained, and a few males and many females of *E. tricolor*. *Prospalta conjugata*, Masi, is a synonym of *E. tricolor*, which is the species recorded as *Prospaltella* (*Doloresia*) *conjugata* [*cf. R.A.E.*, A **4** 55 ; **9** 368]. *E. partenopea* has been recorded from *Trialeurodes vaporariorum*, Westw., in Surrey.

Oldroyd (H.) & Ribbands (C. R.). **On the Validity of Trichiation as a systematic Character in** *Trichogramma* **(Hym., Chalcididae).**—*Proc. R. ent. Soc. Lond.* (B) **5** pt. 7 pp. 148–152, 3 figs., 3 refs. London, July 1936.

By rearing *Trichogramma evanescens*, Westw., on the eggs of different hosts it was established that the number of hairs on the wings of individuals may vary by more than 100 per cent., that it is positively correlated with the length of the wings and therefore with the size of the insect and of the host, and that it is of no systematic significance [*cf. R.A.E.*, A **18** 145].

Some Common Insect Pests of Fruit Trees.—*Trop. Agriculturist* **86** nos. 4–5 pp. 195–205, 259–270, 4 refs. Peradeniya, April–May 1936.

Brief notes are given on the biology and control of the commoner insect pests of fruit trees in Ceylon, which include *Citrus*, mango and a number of less important tropical fruits, and also on insecticides and their application.

The Mediterranean Fruit Fly.—*Trop. Agriculturist* **86** no. 5 pp. 257–258. Peradeniya, May 1936.

Ceratitis capitata, Wied., was intercepted in two large consignments of *Citrus* fruit received in Colombo from Palestine early in May 1936. The consignments were destroyed, and all fruit arriving from the same country during the season will be inspected.

Kalshoven (L. G. E.). **Rotan-boorders.** [Borers attacking Rattan.] —*Ent. Meded. Ned.-Indië* **2** no. 2 pp. 19–21. Buitenzorg, 1st June 1936.

Dried rattan [*Calamus*] in Java is liable to attack by various Coleoptera, including *Dinoderus minutus*, F., and *Minthea rugicollis*, Wlk.

FRANSSEN (C. J. H.). **Two Borers in Durian-Fruits (Lep., Noctuidae and Pyralidae).**—*Ent. Meded. Ned.-Indië* **2** no. 2 pp. 30–32, 1 fig. Buitenzorg, 1st June 1936.

Brief descriptions are given of the larva and pupa of the Noctuid, *Hypoperigea leprosticta*, Hmps., and all stages of the Pyralid, *Tirathaba ruptilinea*, Wlk., which attack the fruits of durian (*Durio zibethinus*) in Java and on which observations were made in 1934. The larvae of *H. leprosticta* bore deeply into nearly ripe fruits, apparently feeding mainly on the seeds. At Buitenzorg pupal stages of 20, 24 and 28 days were observed. The young larvae of *T. ruptilinea* live on the outside of the fruits, feeding on the thorns. Later on they bore in, either between or in the thorns. Up to 15 larvae have been found in one fruit. The larval stage probably lasts about 3 weeks and the pupal stage lasted 6–12 days. Pupation takes place between the thorns. The larvae have also been found in the fruits of *Sorghum*, castor (*Ricinus communis*), Dipterocarpaceae, and sapodilla (*Achras sapota*). Infested durian fruits are often secondarily attacked by the larvae of *Drosophila punctipennis*, Wulp.

DE FLUITER (H. J.). **Voorloopige mededeeling i.z. het onderzoek over een engerlingplaag in de Java-koffie.** [A preliminary Communication regarding an Investigation on an Attack on Coffee in Java by Larvae of *Lachnosterna*.]—*Bergcultures* **10** no. 12–13 reprint 8 pp., 2 figs., 9 refs. Batavia, 1936.

The larvae of a species of *Lachnosterna*, the adult of which is briefly described, have done considerable injury to coffee in the Idjen Plateau and Kendeng Hills, Java, by feeding on the roots. Larvae from these areas were bred at Djember, where the climate is warmer, and were found to prefer the roots of coffee to those of other plants. In the plantations the greatest injury was caused to bushes planted to fill up gaps. Such bushes were killed, as only the main root was left, and sometimes even this was attacked. Bushes more than 4 years of age have an extensive root system and can replace losses. The flight period occurred at the end of the east monsoon (dry season) and beginning of the west monsoon (wet season), and in 1935 the first adults were seen above ground at the end of September and early in October. The weather was very dry in 1935, and the rains did not set in properly until January 1936, so that mass flight over a short period did not occur as it had in other years. At Djember the egg-stage lasted 10–12 days ; it was longer in the plateau region, probably by 1–1½ weeks. Larvae were present throughout the rainy season, and the injury increased as they grew older in January–March. At Djember larvae that had hatched early in December began to pupate about mid-April, and the pupal period averaged 13½ days. On emerging, the adults in the plateau region remained in the ground inactive through the dry season, no other stage being found at this time, but at Djember they appeared at the surface after a rest of 3 weeks. They contained no mature eggs, however, and though they fed and flew, all died in 5–6 days. On the plateau they were first seen early in May and most of them remained at a depth of 12–19 ins. until towards the advent of the rains, when they occurred at 2–6 ins. and could be collected by superficial hoeing. In one instance adults appeared before the first rain, probably stimulated by heavy dew. They fed on leaves and in the laboratory

preferred dadap to coffee or other plants that occur in coffee plantations. The observed maximum number of eggs in a female was 31.

Experiments are being made in the hope of finding measures for control. Collection of the adults by hoeing may be useful in dry years, but in wet ones mass flight is sudden and the time available is too short. The larvae are parasitised by Scoliids and though those occurring in the plateau region have been of little value, imported species might prove more effective. Instead of filling the gaps with young coffee plants, older bushes from 7 to 10 years of age have been tried with success.

Gordon (A.). **Path of Flight.**—*Science* **84** no. 2167 pp. 40–41. New York, 10th July 1936.

During the campaigns in 1932, 1933 and 1936 against *Locusta migratoria manilensis*, Meyen, in the Philippine Islands, the author observed that the flight of the swarms, and of the individual locusts composing them, is in general in an anti-clockwise direction. This direction is maintained under normal atmospheric conditions unless interfered with by relief, or head or tail winds, which blow the insects off their course in all directions. It is suggested that in the southern hemisphere the flights of swarms are clockwise.

Yago (M.) & Ishikawa (H.). **Ecological Notes and Methods of controlling the Pear Fruit Borer, *Carposina sasakii* Mats.** [*In Japanese.*]—*Bull. Shizuoka-Ken agric. Exp. Sta.* no. 39, 27 pp., 2 pls. Shizuoka, Japan, March 1936.

Descriptions are given of all stages of the Tortricid, *Carposina sasakii*, Mats., which is widely distributed in Japan and Manchuria, attacking pears and sometimes peaches. In Shizuoka it has one or occasionally two generations a year. The overwintered larvae pupate in the second half of June or early July, and the pupil stage lasts about 10 days. The females fly between 7 and 12 p.m. and the males all night. Both sexes are attracted by light, especially after 8–10 p.m. The eggs are laid in depressions on the fruits, each fruit bearing on an average 2·86, and take 8–9 days to hatch. One female laid 189 eggs in 6 days. The larvae bore into the fruits and sometimes migrate from one to another; from 1 to 13 may be found in a single pear. After 18–26 days they leave the fruit and make cocoons in the soil; even larvae that leave the fruit as early as the end of July may enter hibernation.

Sprays of lead arsenate, derris or nicotine sulphate and poison baits for the moths have not proved effective for control. Infestation can be prevented by enclosing the fruits in bags before the moths emerge.

Koidzumi (K.). **Transportation of Formosan Vegetables and Fruits to Japan and the Problems of Fruit-flies.** [*In Japanese.*]—*Agric. & Hort.* **11** no. 5 pp. 1185–1193. Tokyo, May 1936.

Dacus (*Chaetodacus*) *dorsalis*, Hend., infests *Citrus* and many other fruits in Formosa. The importation of these fruits into Japan is prohibited, except *Citrus* fruits that have been inspected and fumigated with carbon bisulphide. *D.* (*C.*) *cucurbitae*, Coq., infests cucurbits, and only watermelons that have been inspected are allowed to be brought into Japan. A brief account is given of the biology of these flies in Formosa, together with an annotated list of fruit-flies of economic importance outside the Japanese Empire.

KOIDZUMI (K.). **Heat Sterilisation of Formosan Fruits against Fruit-flies. I. Preliminary Determination of the Thermal Death Points of *Chaetodacus ferrugineus dorsalis* Hendel and *C. cucurbitae* Coq. II. Results on "Tankan" (*Citrus tankan* Hayata).** [*In Japanese.*] —*J. Soc. trop. Agric. Formosa* **8** no. 2 pp. 157–175. Taihoku, Formosa, June 1936.

From preliminary experiments in which the insects were kept in test tubes, with food in those containing the eggs and larvae, it was found that the eggs, larvae and pupae of *Dacus* (*Chaetodacus*) *dorsalis*, Hend., and *D.* (*C.*) *cucurbitae*, Coq., rarely progressed to a further stage of development if they had been exposed to temperatures of 40–46°C. [104–114·8°F.] for 1–2 hours. All the immature stages of *D. dorsalis* were killed by exposure to 40°C. [104°F.] for 5–7 hours, 42°C. [107·6°F.] for 4–6, 44°C. [111·2°F.] for 2–4 and 46°C. [114·8°F.] for 1, and those of *D. cucurbitae* by exposure to the same temperatures for 6–7, 3–6, 1–3, and 1 hour, respectively.

In further experiments, eggs and larvae of *D. dorsalis* in fruits of *Citrus tankan* were killed by keeping the fruits in thermostats saturated with water vapour and maintaining the temperature at 40°C. [104°F.], or 42°C. [107·6°F.] for 16 hours, 43°C. [109·4°F.] for 8, or 44–46°C. [111·2–114·8°F.] for 4. The fruits were not affected.

WATANABE (S.). **On a "Virus" Disease of Pineapple.** [*In Japanese.*] —*Trop. Hort. Formosa* **6** no. 2 pp. 1–32, 13 figs. Taihoku, Formosa, June 1936.

A disease of pineapple has caused serious damage in the south of Formosa during the past few years. It was observed from indoor experiments that the healthy plants infested by *Pseudococcus brevipes*, Ckll., always developed "green spots" on the leaves [*cf. R.A.E.*, A **23** 166, etc.] within 5 days, and some of the plants showed the disease, whereas uninfested plants remained healthy. The author concludes that the chief cause of the disease in Formosa is the mealybug. Derris sprays have proved of some value in its control.

MATSUMOTO (F.). **On the Life History of *Ischnodemus saccharivorus* Okajima injurious to Sugar Cane in Formosa (Lygaeidae, Hemiptera), II.** [*In Japanese.*]—*Trans. nat. Hist. Soc. Formosa* **26** no. 154 pp. 291–303. Taihoku, June 1936.

From further observations on the Lygaeid, *Ischnodemus saccharivorus*, Okajima, on sugar-cane in Formosa [*cf. R.A.E.*, A **23** 708], it has been found that the female adults live for 25–57 days and the males for 22–43 days during the summer, though both sexes die in 2–7 days if without food. They may be either brachypterous or macropterous, but cannot fly and live gregariously among the leaves and under the leaf-sheaths of the sugar-cane. They pair several times in June, 5–10 days after emergence, and the females oviposit under the leaf-sheaths along the margins 1–15 days later. One female lays 5–16 eggs in a row and produces up to 150 eggs in a month, though 63 eggs is about the average number. The overwintered adults die before the beginning of May.

Okada (J.). **Studies on the Effect of Boracic Acid in the Control of Rice Weevils.** [*In Japanese.*]—*Yamaguchi-Ken agric. Exp. Sta. Extra Rep.* no. 1, 70 pp., 2 pls. Yamaguchi, March 1936. (With a Summary in English.)

Experiments against the rice weevils, *Calandra oryzae*, L., and *C. sasakii*, Tak., in Japan showed that injury to stored rice is prevented by mixing boracic acid with it at the rate of 1 : 800 by weight in tightly closed vessels or 1–1·2 : 600 in granaries. This treatment is less effective for wheat. The application of the acid, however, reduces and retards the germination of the seeds and tends to affect the formation of chlorophyll. No effect was observed on the value of bran from the treated rice or wheat, either as a manure for crops or as food for animals or fowls, though the fertility of the fowls seemed to be slightly reduced.

Morino (I.), Homma (K.), Taniguchi (T.) & Ando (N.). **Studies on the Chemical Control of the Rice Borer,** *Chilo simplex* **Butl.** [*In Japanese.*]—*Nojikairyo-Chiryo* no. 115, 154 pp., 4 pls. Tokyo, March 1936. (With a Summary in English.)

Chilo simplex, Butl., is the most injurious pest of rice in Japan, and during 1926–31 experiments were made to determine satisfactory insecticides for controlling it. The best was nicotine, which was more effective in the form of a tobacco dust (combined with 5 per cent. sulphur and 15 per cent. lime) than as a spray of nicotine sulphate (1 : 800) with 1 lb. soap to 20 gals. Though nicotine kills some of the Hymenopterous egg parasites, it is very efficient in killing the eggs, larvae and adults of the moth, especially eggs in the later stages of development, and in preventing oviposition and the entrance of the newly hatched larvae into the stalks.

Chloropicrin was the best fumigant for destroying the hibernating larvae in the bundles of straw. At least 1·5 lb. was required per 1,000 cu. ft. with an exposure of 2 days or more.

Shibuya (M.) & Yamashita (S.). **Studies on the Utilisation of a Hymenopterous Parasite of the Rice Borer introduced from the Philippines.** [*In Japanese.*]—*Nojikairyo-Chiryo* no. 116, 41 pp., 7 pls. Tokyo, March 1936.

A species of *Trichogramma* that parasitises the eggs of *Chilo simplex*, Butl., was imported into Japan from the Philippines in 1929. It was easily reared on the eggs of *Ephestia cautella*, Wlk., and also infested those of *Ancylolomia chrysographella*, Koll., *Aphomia gularis*, Zell., *Barathra brassicae*, L., *Dendrolimus spectabilis*, Butl., *Herse convolvuli*, L., *Homona coffearia menciana*, Wlk., *Naranga aenescens*, Moore, *Papilio xuthus*, L., *Parnara guttata*, Brem., and *Sitotroga cerealella*, Ol.

When reared on eggs of *E. cautella*, 16 generations were produced from June to early December 1930 and 20 from March to December 1931. The parasites did not survive in host eggs kept during the winter in an open insectary where the minimum temperature was —4·4°C. [24·08°F.]. In cool storage, when 9–10·8°C. [48·2–51·44°F.] was the daily mean temperature, the percentage of pupation of the parasites was reduced and no adults emerged. The time spent in the egg of the host varied from 5·5 to 84·5 days, and was 3–5 days longer than usual in eggs of *P. xuthus* or *D. spectabilis* on account of their large size. When fed on sugar solution, the average life of the adult females was 5 or 6 days

and of the males 3 or 4. Females produced an average of 21·2 eggs. About 30 per cent. of the offspring of paired females were males, and unpaired females produced males only. The number of parasites in each host egg depended upon its size. The eggs of *E. cautella*, *C. simplex* and *S. cerealella* generally yielded only one parasite, but those of *D. spectabilis* produced as many as 69, and the larger the host the larger the parasite and its fecundity. When allowed to oviposit in eggs of *C. simplex*, 60–70 per cent. of the parasites did not produce offspring.

During June 1933, 35,000 parasites were released in an area of 840 sq. yds. of newly planted rice, and as a result 41·2–50·6 per cent. of the egg batches or 4·3–4·8 per cent. of the individual eggs of *C. simplex* were parasitised. As a much higher percentage of the eggs was parasitised by the indigenous *Trichogramma japonicum*, Ashm., the introduced species does not seem likely to be of much value.

Sakai (K.) & Shinkai (S.). **Studies on the Chemical Control of Leafhoppers.** [*In Japanese.*]—*Nojikairyo-Chiryo* no. 118, 157 pp., 4 pls. Tokyo, March 1936. (With a Summary in English.)

Nephotettix bipunctatus cincticeps, Uhler, *Deltocephalus dorsalis*, Motsch., *Delphacodes striatellus*, Fall., *Sogata furcifera*, Horv., and *Nilaparvata oryzae*, Mats., are very injurious to rice in Japan, and have frequently occurred in such large numbers that famine has been threatened. As a result of experiments on control carried out since 1928, it is concluded that the most effective measure is to apply oil on the water in the rice-fields and then brush the insects off the plants. The diffusion of the oil is much greater at low temperatures, and it is best applied in the early mornings on days that are fine or cloudy and calm. The addition of pyrethrum (4·2 lb. to 10 gals.) adds to the efficiency of the oil, which should be applied at the rate of 3½–4 gals. per acre.

Kerosene and light oils are the most generally used, as lubricating oil tends to injure the rice. Mixtures of mineral, animal and vegetable oils are also very effective, but expensive. When the fields are dry, effective control has been obtained with a spray of 42 lb. pyrethrum and 42 lb. soap in 100 gals. water, and also with dusts of pyrethrum and wood ash (1 : 80) or tobacco dust and lime (7 : 3), at the rate of 33 and 13½ lb. per acre, respectively.

Bokura (U.). **Cares in Preventing Citrus Canker.** [*In Japanese.*]—*J. Plant Prot.* **23** pp. 431–435. Tokyo, June 1936.

In Japan, leaves of *Citrus* injured by *Phyllocnistis citrella*, Stn., are often attacked by citrus canker, so that measures against the moth are necessary for preventing the disease.

Tabe (C.). **On *Contarinia* sp., a new Pest of Apple.** [*In Japanese.*]—*J. Plant Prot.* **23** pp. 509–518. Tokyo, July 1936.

Descriptions are given of all stages of a species of *Contarinia* that attacks apple in the Nagano Prefecture, where it was first observed in 1926. It has one generation annually, passing most of the year in the pupal stage in the soil. The adults emerge during the day, usually in late March or early April; the females live for 4–27 days and the males for 3–10. They feed on the honey-dew of Aphids and drops of water and

pair several times, the day after emergence, when the temperature is above 10°C. [50°F.]. The females begin to oviposit in the flower buds of apple 3–10 days after emergence at a temperature above 17°C. [62·6°F.], producing 46·9 eggs on an average. The larvae pupate at the end of May.

SAWADA (E.). **Effect of Spraying with Bordeaux Mixture and Lime-sulphur on the Outbreaks of Insects on** *Citrus*. [*In Japanese.*]—*J. Plant Prot.* **23** pp. 518–522. Tokyo, 1936.

The use of strong Bordeaux mixture as a fungicide on *Citrus* in Japan results in outbreaks of *Phyllocoptes* (*Eriophyes*) *oleivorus*, Ashm., but sprays of lime-sulphur prevent injury by this mite.

TAKAHASHI (S.). **Results of Studies on** *Pseudococcus comstocki* **Kuwana.** [*In Japanese.*]—*Niigata-Ken agric. Exp. Sta. Extra Rep.* no. 36, 120 pp., 7 pls. Niigata, Japan, 1936.

Pseudococcus comstocki, Kuw., all stages of which are described, was first noticed as a serious pest of pear in the Niigata Prefecture in 1921, infesting the fruits as well as the leaves and branches. It also attacks grape, persimmon, the roots of soy beans, watermelons, and other plants, if they grow near pear trees, and can be bred on mulberry. There are 3 generations a year, the eggs hatching in mid-May, mid-July, and in late August. The winter is generally passed in the egg stage. Oviposition occurs in late June and early July, in August and in October. The female begins to lay eggs in sheltered places on the tree 8 days after the last moult, producing a total of about 362. Oviposition was completed in 5·5 days in an experiment. The crawlers hatch in 8–13 days in summer and in an experiment lost the ability to move in about 65 hours. The male larvae move again at the end of the second instar and spin cocoons for pupation, the larval, prepupal and pupal stages lasting 12–24, 1–4 and 2–9 days, respectively. The females have 3 larval instars and reach the adult stage in 17–33 days. The mealybugs are parasitised by *Clausenia purpurea*, Ishii, though it is rare, and their eggs by Cecidomyiids and mites. Measures recommended for control include cleaning the stems and branches of the trees to remove shelter, and the use of dormant sprays of oil emulsion in autumn or lime-sulphur in early spring to kill the eggs.

TAKIZAWA (M.). **Studies on the Apple Fruit Borer,** *Grapholitha inopinata* **Heinr.** [*In Japanese.*]—*S. Manchuria Rly agric. Exp. Sta. Bull.* no. 16 pp. 77–113, 6 pls. Yugakujo, Manchuria, 1936.

Cydia (*Grapholitha*) *inopinata*, Heinr., all stages of which are described, is very injurious to apple in southern Manchuria. It has 2 generations a year, and hibernates as a full-grown larva in the cocoon. The moths emerge between the end of May and the beginning of July, and again in late July and August. They are dormant at night, but active in the early morning and evening, and live for about a week. The females begin to oviposit a day after emergence, producing 52·3 eggs in 5·9 days on an average and usually laying them in the depressions at the tops of the apples. The egg stage lasts 4–13 days, but averages 4–5. The larvae bore into the fruits, but rarely penetrate as far as the centre. They mature in fruits of wild apple, *Crataegus*, plum and pear in captivity. After 12–47 days, they leave the apples at

night and spin cocoons on the stems of the trees. The pupal stage averages 8·8 days in summer, and 15 in spring. The larvae are parasitised by *Phaedroctonus* spp. and *Mesochorus* spp.

Sprays of 4·5 lb. lead arsenate and 0·1 gal. nicotine sulphate in 90 gals. water are very effective in control, and the larvae can be trapped in shelter bands. Poison baits have not proved of value.

NAKAYAMA (S.). **Experiments on the Introduction, Establishment and Utilisation of *Aphelinus mali* Haldem., a Parasite of *Eriosoma lanigerum* Hausm. First Report.** [*In Japanese.*]—*J. agric. Exp. Sta. Corea* **8** no. 2–3 pp. 136–149, 1 pl. Suigen, 1936.

Eriosoma lanigerum, Hsm., is a serious pest of apple in Korea, where it was first observed 26 years ago. *Aphelinus mali*, Hald., a description of which is given, was imported against it from Japan in March 1934 and established. The parasites were active in the open from late April until early October, and in Suigen in 1935 produced 12 generations, hibernating in the larval stage in the host. One generation was completed in 18·5 days in spring, 9·3 in summer and 13·7 in autumn.

Sprays of lime-sulphur, lead arsenate and lime, or nicotine sulphate hardly affected the parasites, for 75 per cent. emerged if the hosts had been sprayed with nicotine sulphate, and over 90 per cent. if they had been sprayed with the other materials.

KING (C. B. R.). **Report of the Entomologist for the Year 1935.**—*Bull. Tea Res. Inst. Ceylon* no. 13 pp. 35–40, 1 graph, 1 ref. Talawakelle, Ceylon [1936].

Among the pests of tea in Ceylon in 1935 the most commonly reported was *Zeuzera coffeae*, Nietn., which bores in the branches, sometimes killing young plants. *Prodenia litura*, F., was again observed on tea estates [*cf. R.A.E.*, A **23** 638] but in every case its original food-plant appeared to have been *Oxalis*. It only attacks tea in the absence of other food, and then only feeds on the old coarse leaf. It was occasionally parasitised by *Podomyia setosa*, Dol. The Trypetid, *Adrama austeni*, Hendel [*cf. loc. cit.*] was reported in three places but there is no evidence in Ceylon that it is a pest. Attempts to breed it have failed and it is thought probable that it oviposits only in unhealthy tea seeds, to which it is attracted by the products of decomposition. Larvae of *Hasora* (*Parata*) *chromus*, Cram., that had fed on mahogany were found pupating on the larger leaves of tea bushes. In spite of a dry season, *Homona coffearia*, Nietn., was less numerous than usual, possibly on account of the intensive collection of egg masses during the previous years. Following the conclusion that *Trichogramma* could not be economically used to control this Tortricid [**22** 167 ; **24** 136], a consignment of parasites was obtained from Java, from which 7 species were reared of which 6 had not hitherto been found in Ceylon. Of these, 2 species were represented only by 1 male each, and 3 by a small number of individuals, including females. The last, of which several hundreds emerged, may be useful if it can be acclimatised. The number of outbreaks of nettle grubs [Limacodids] on tea and the acreage affected during the last 5 years and during each month of 1935, when there was a great decrease in infestation, are given in tables, and a graph shows that during each of the last 5 years the outbreaks were most numerous about June. None of several insecticides tested has been

found to supersede plain soap and water. The most satisfactory, an ovicide consisting of kerosene and liquid fuel applied with an atomiser, destroyed 100 per cent. of the eggs it reached without harming the foliage, but it is difficult to find the eggs. *Microbracon hebetor*, Say, was reared and dispatched to India for use against Lepidoptera predacious on the lac insect [*Laccifer lacca*, Kerr].

ROONWAL (M. L.). **On the Existence of two different Types of striped Eyes among Solitary Type Specimens of the Desert Locust** *Schistocerca gregaria* **Forsk.**—*Curr. Sci.* **5** p. 24, 2 figs. Bangalore, July 1936.

The compound eyes of *Schistocerca gregaria*, Forsk., ph. *gregaria* are uniformly claret-coloured, while those of ph. *solitaria* have a number of alternating chocolate-coloured and cream-coloured stripes. The histological basis of this difference is discussed. Among the ph. *solitaria* locusts in the breeding ground of Mekran (Baluchistan), the majority had compound eyes with six chocolate stripes, the remainder having seven.

HUSAIN (M. A.) & AHMAD (T.). **Studies on** *Schistocerca gregaria* **Forsk. II. The Biology of the Desert Locust with special Relation to Temperature.**—*Indian J. agric. Sci.* **6** pt. 2 pp. 188–262, 6 figs., 13 refs. Calcutta, April 1936.

The following is taken largely taken from the authors' summary:

The effect of temperature on the duration of different stages in the life-cycle of *Schistocerca gregaria*, Forsk., was studied under conditions of constant and room temperatures. The pre-oviposition period (after the last moult) varied from 14·2 days at a constant temperature of 40°C. [104°F.], to 32 days at 27°C. [80·6°F.]; below 18°C. [64·4°F.] the average pre-oviposition period lasted 131 days. The maximum number of egg-pods obtained from one female was 11. The theoretical threshold of development of the eggs lies at 17–18°C. [62·6–64·4°F.], and the incubation period varies from 85 days at 18·5°C. [65·3°F.] to a minimum of 9 days at a temperature above 40°C. Exposure for 8 hours to 46°C. [114·8°F.] is fatal. Larval development cannot take place below 20°C. [68°F.] or above 46°C.; at 27°C. it lasts 62 days and at 36–40°C. [96·8–104°F.] only 20. The length of adult life is inversely proportional to temperature; at 36°C. and over it lasts 1 month and at temperatures below 30°C. [86°F.] it lasts 2–3 months.

It is concluded that there is no diapause in any stage of development, the duration of all of them depending upon the environmental conditions. In the Punjab there are only two generations a year, but should temperature conditions prove favourable, several broods can be produced.

An account of experimental cages used for the breeding of locusts is included.

HUSAIN (M. A.) & MATHUR (C. B.). **Studies on** *Schistocerca gregaria* **Forsk. III. Why Locusts eat Wool. A Study in the Hydromania of** *Schistocerca gregaria*.—*Indian J. agric. Sci.* **6** pt. 2 pp. 263–267, 6 refs. Calcutta, April 1936.

In a series of experiments on caged adults of *Schistocerca gregaria*, Forsk., moist wool was only eaten after the locusts had been kept for

24 hours at 37°C. [98·6°F] and low relative humidity, and without green food. The wool itself does not attract the locusts, and its acceptance is determined by the moisture contained in soaked wool.

ANDREWARTHA (H. G.). **A preliminary Survey of the Far North District as a possible endemic Area for Plague Grasshoppers.**—*J. Dep. Agric. S. Aust.* **39** no. 10 pp. 1223–1224, 1 map, 1 ref. Adelaide, May 1936.

Continuing the survey of the possible breeding areas of plague grasshoppers in South Australia [*R.A.E.*, A **24** 445], an examination was made of the Flinders Ranges and the plains immediately to the west and east of them. Certain Acridids were present in limited numbers in specialised habitats, but *Chortoicetes terminifera*, Wlk., strikingly the dominant species, was present everywhere, though the whole area was suffering from drought. It was sparsely distributed in the more barren areas and more abundant, though never gregarious, where there was vegetation, whether salt bush (*Atriplex*), grass or herbaceous plants. In certain of these areas an adult might be disturbed every 2 or 3 yards. It appeared that 50 per cent. of the individuals were green. There were apparently swarms of *C. terminifera* in the Flinders Ranges in the spring of 1934, which bred locally from eggs laid in the autumn of that year. Grasshoppers had apparently been dense there in the spring of 1931, but there is no record that swarms were present in 1932 or 1933. This was probably not an important breeding ground in the outbreak that reached its climax in 1934.

CORBETT (G. H.). **On new Aleurodidae (Hem.).**—*Ann. Mag. nat. Hist.* (10) **16** no. 92 pp. 240–252, 7 figs. London, 1935.

Descriptions are given of one new genus and seven new species of Aleurodids, including *Trialeurodes caricae* on papaya in Trinidad, *Aleuromarginatus* (gen. n.) *tephrosiae* on *Tephrosia candida* in Sierra Leone, *Bemisia goldingi* on cotton in Nigeria, and *B. nigeriensis* on cassava [*Manihot utilissima*] in Nigeria.

DOWSON (V. H. W.). **A serious Pest of Date Palms,** *Ommatissus binotatus*, **Fieb. (Homoptera : Tropiduchidae).**—*Trop. Agriculture* **13** no. 7 pp. 180–181, 2 refs. Trinidad, July 1936.

During 1935, considerable damage was done to date palms in Basrah by the Tropiduchid, *Ommatissus binotatus* var. *libycus*, Bergevin. A Fulgoroid [*R.A.E.*, A **10** 402] reported during 1919 and 1921 from northern Iraq and Basrah is thought to be the same species. The only recorded occurrence of this bug outside Iraq is at Siwa in the Libyan desert of Egypt [**22** 190]. Symptoms of attack were noticed at Basrah in 1933. In 1934 they became considerably worse and in 1935 few of the seven million palms in the area were entirely free. The eggs, which are described, were laid singly in nearly straight rows of 6–24, parallel to the long axis of the leaflet, usually on the upper surface [*cf.* **22** 190]. Early in April, the newly hatched nymphs migrate towards the heart of the palm. In 1935 adults were seen on 21st May and nymphs of all sizes on 25th April, but symptoms of attack had been apparent much earlier.

The bugs, of which there may be thousands on each frond, cover the greater part of the palms with honey-dew, which ferments, producing an acid smell. It is attacked by a fungus and blackens, causing the

fronds to wither, and the spadices of the spikes of young dates to give way. It is thought that badly infested palms sometimes die in the year following the attack. The damage in the Basrah area in 1935 was roughly estimated at £80,000. A dust of 5 per cent. nicotine sulphate and finely powdered slaked lime, and a spray of $\frac{1}{8}$ per cent. nicotine sulphate in a $\frac{1}{2}$ per cent. solution of yellow washing soap give good control. At Basrah, the cost of the dust is $6\frac{1}{2}$d. per palm, and of the spray, $9\frac{3}{4}$d. for 15 gals., the amount needed to treat 1 palm, or £4 1*s*. 3*d*. per acre. Tobacco in a $\frac{1}{2}$ per cent. soap solution (1 lb. to 44 gals.) gives fair control. Great care must be exercised to make the insecticides reach the bugs on the inner side of the leaflets. An excellent control is obtained by drenching the trees with water applied at sufficient force to knock down the bugs and bury them in the mud. A 2 H.P. fire engine with a $\frac{1}{2}$ in. nozzle is sufficiently powerful for trees 10 years old.

GOLDING (F. D.). *Bemisia nigeriensis* **Corb., a Vector of Cassava Mosaic in Southern Nigeria.**—*Trop. Agriculture* **13** no. 7 pp. 182–186, 6 refs. Trinidad, July 1936.

Experiments in Nigeria on the transmission of mosaic of cassava [*Manihot utilissima*] by *Bemisia nigeriensis*, Corbett [*R.A.E.*, A **23** 605] were continued in 1935. On 3rd August two healthy cuttings of bitter cassava were planted in each of 10 muslin cages, and 50–400 adults of *Bemisia* from infected plants in the field were introduced into each of 6 cages, sometimes in 1, and sometimes in 2 or 3 batches, from 17th September to 17th October. In the cage containing 400 adults symptoms of mosaic were observed on one plant on 4th October, 13 days after the first introduction of *Bemisia* and the second plant became infected over 6 weeks later, the virus having probably been carried from one to the other. At the conclusion of the experiment on 9th January 1936, no plants in the other 9 cages had showed signs of infection. In experiments on plants grown in lamp chimneys, mosaic appeared in 2 chimneys containing respectively 26 and 64 Aleurodids, 27 days after their introduction, but not in the 2 other chimneys containing the supposed vectors nor in the controls. These were the only experiments in which positive results were obtained when the number of insects introduced was less than 400. This may be accounted for by the fact that paper caps forced the insects on to the plants in the unshaded parts of the chimneys so that an unusually short time elapsed between feeding on diseased and healthy plants. Of 4 healthy plants in a muslin cage into which 606 adults were introduced between 11th and 28th November, 2 developed mosaic on 2nd December, 1 on 30th January and the last on 15th February. Aleurodids, thought to be *B. nigeriensis*, are found on *M. glaziovii*, and a weed, *Euphorbia heterophylla*, but neither of these plants was infected experimentally by adults of *Bemisia* from diseased cassava.

The incidence of adults of *Bemisia* on 19 varieties of cassava was studied over a period of 34 weeks. When the first counts were made, none of the plants of 7 varieties showed mosaic symptoms while all the plants of 7 others were infected. Varieties that showed resistance to mosaic were almost invariably more lightly infested by the Aleurodids. Experiments to determine whether resistance to mosaic depended on some property that rendered the plants repellent to the vectors showed that it was due rather to an inherent resistance to the virus, as some plants bearing a large number of adults remained quite healthy. All the resistant varieties had deep purple petioles. Of the susceptible

varieties 5 had green petioles, and 5 purple. The immature Aleurodids, which are invariably found on the lower surface of the leaves, were present on all of the 19 varieties of cassava, the numbers in all cases except 4 being proportionate to those of the adults. Exotic varieties were less favoured by ovipositing females than indigenous ones.

Breeding was continuous from early August 1935 to the end of March 1936. There appeared to be a generation once in every 4 or 5 weeks. Immature stages were most plentiful in early September and mid-January, but scarce in mid-November and in March. The numbers of adults decreased from 20th August to mid-November, increased until the end of December, owing to concentration resulting from the scarcity of available food, and then decreased again until March. Heavy rains destroyed large numbers of the adults. Their principal natural enemies were small spiders; no parasites or predators of the immature stages were found.

It has been suggested that *B. nigeriensis* may be identical with *B. gossypiperda*, Misra & Lamba, the vector of leaf-curl of cotton in the Sudan. If this is so, it is curious that *nigeriensis* has never been recorded from cotton in Nigeria, where the Aleurodid responsible for transmitting leaf-curl of cotton [**18** 364] is *B. goldingi*, Corbett.

Bouvier (G.). **Une épidémie chez les sauterelles migratrices. Isolement d'un bacille pathogène. Essais de transmission de la maladie.**—*Ann. Inst. Pasteur* **57** no. 1 pp. 91–104, 5 refs. Paris, July 1936.

In February 1934, large numbers, and sometimes whole swarms, of *Nomadacris septemfasciata*, Serv., and *Locusta migratoria migratorioides*, R. & F., were reported dying, the former in Gandadjika and Lusuku, and the latter in Kadiata, Belgian Congo. Inoculation with a culture prepared from dead *Nomadacris* did not prove fatal to healthy locusts. A number of bacilli, which are described, were obtained from dead *Locusta*, by means of the usual culture methods. The culture of a bacillus referred to as "H" was very virulent when inoculated into the body cavity of *Nomadacris* hoppers, and the fatal disease caused by it was found to be contagious.

In an experiment on infecting 6,365 caged *Nomadacris* adults by spraying the banana leaves on which they fed with a culture of bacillus "H," 37 per cent. of the locusts were dead in 60 hours and the remaining ones were sluggish. In the control lot of 5,380 locusts only 20 per cent. died during that period, and the rest appeared to be lively and healthy. However, owing to the difficulties of keeping caged *Nomadacris*, these results are not considered to be conclusive.

Bouet (G.). **Nouvelles recherches sur les cigognes blanches d'Algérie.**—*Oiseau* no. 2 pp. 282–301, 1 map, 10 refs. Paris, 1936.

In the course of research on the migrations of storks nesting in northern Africa, the author studied the density of the stork population in Algeria. This was undertaken in view of complaints from South Africa that the use of poisoned bait in the control of locusts, on which the storks readily feed, led to an extensive mortality of the latter. The statistical study of the population showed that there is no diminution in the numbers of nesting pairs of storks in Algeria. In 1931 the author observed several cases of storks dying after eating locusts poisoned with arsenic, but no cases of poisoning of storks have been reported during subsequent campaigns.

Marelli (C. A.). **Cambio en el regimen alimenticio de un insecto *Colaspis varia* Lef. de la familia de los Crisomélidos atacando la vid.** [A Change in the Diet of a Eumolpid, *C. varia*, attacking the Grape-vine.]—*Pharus* **1** no. 3 pp. 18–19, 3 figs. La Plata, March 1936.

The Eumolpid, *Colaspis varia*, Lef., attacks the foliage of grape-vines in Argentina, and a recently observed instance of destruction of the immature bunches, of which only the stem and peduncles were left, is also attributed to it.

López Cristóbal (U.). **Dos nuevos enemigos de la fruticultura argentina y un epiparásito nueva especie.** [Two new Pests of Argentine Fruit Culture and a new Parasite.]—*Pharus* **1** no. 3 pp. 51–53, 68–70, 17 figs., 4 refs. La Plata, March 1936.

In the course of experiments in La Plata, Argentina, in 1934–35 to obtain parasites of *Cydia* (*Laspeyresia*) *molesta*, Busck, only one adult of *C. pomonella*, L., was bred from 200 infested apples and 200 infested pears. It is therefore concluded that *C. pomonella* is of negligible importance in La Plata and that the arsenical sprays regularly applied against it are unnecessary. In cages where infested fruits were ripening, *Tortrix* (*Archips*) *rosaceana*, Harr., was constantly obtained, sometimes, especially in January and February (mid-summer), in the same abundance as *C. molesta*. Both species were obtained from apples, pears, peaches and plums. *T. rosaceana* has not been previously recorded as a pest in Argentina and observations on its bionomics were therefore made. The larvae of the spring generation very rarely attacked the developing fruits. They fed for 10–14 days on the tender leaves and then pupated in silken cocoons in cracks in the bark or among the débris under the tree. After 8–11 days the adults emerged, living up to 2 weeks. The larvae of the second generation at the end of December fed for up to 5 days on the parenchyma of the leaves and then mined early maturing fruits, especially plums and early pears, remaining in them for up to 9 days. The last generation occurred in February, lived for up to 4 days on the leaves and then attacked all fruits. Owing to the habit of feeding on the leaves, control with an arsenical spray would be easy.

Two parasites, *Pimpla behrensiella*, Blanch., and *Brachymeria pseudovata*, Blanch., emerged together with adults of *C. molesta* and *T. rosaceana* in cages containing infested fruits. The host of *P. behrensiella* was not ascertained, but *B. pseudovata* [*cf. R.A.E.*, A **24** 381] was parasitic on *T. rosaceana* and it is proposed to breed it for use against this pest.

Another Tortricid, *Argyrotoxa semipurpurana*, Kf., which was observed on grape-vines and plums, is also recorded as a new pest in Argentina.

López Cristóbal (U.). *Laspeyresia molesta* **Busck y sus parásitos argentinos.** [*Cydia molesta* and its Argentine Parasites.]—*Rev. Fac. Agron. La Plata* **20** no. 2 pp. 140 et sqq. (reprint 32 pp.), 21 figs., 19 refs. Buenos Aires, 1935. [Recd. July 1936.]

In 1929, *Cydia* (*Laspeyresia*) *molesta*, Busck, was reported to be attacking peaches severely in the islands in the Paraná delta, Argentina, and it has now become the most widespread pest in La Plata, causing

estimated losses of up to 60 per cent. in 1934–35. Attempts to acclimatise parasites from the United States have failed.

In 1934 the first larvae were seen on 15th–17th October, and in the first half of November peach shoots were infested generally. At the same time in another locality quince was attacked while many varieties of peach were uninfested. These differences are ascribed to physiological factors due to ecological conditions and the composition of the soil. From the second half of October 1934 to the second half of April 1935, 5 generations of adults were observed, but up to 8 seem possible. On 2nd July larvae were active on nursery plants and many, unprotected by a cocoon, were hibernating on the twigs and shoots of old trees. In similar mild years early pruning would considerably decrease the numbers of larvae. In experiments with potted plants the larvae remained in the shoots for 11–12 days after hatching and then pupated, the adults emerging 12–14 days later. Larvae on cut twigs planted in damp sand left the twigs and pupated in corners of the cage in 6 days and many became adult after 10 days or less. Such adults were small, as were also adults from infested fruits matured in cages. Larvae infesting ripe, rapidly decomposing pears in the laboratory pupated in 6–12 days, the resultant adults varying considerably in size. In cages, twigs laid horizontally were abandoned within a day, the larvae seeking corners of the cages in order to pupate. From twigs planted upright in damp sand or water, the larvae did not migrate for at least 4 days. It therefore appeared that the usual practice of pruning in spring and summer is useless against *C. molesta* if the prunings are left on the ground for even a few hours, and this assumption was confirmed by observation. The entrance hole is in the upper part of the fruit, close to the stalk if the fruit is isolated. If fruits are touching each other or are close to the branch the favourite entrance is at the point of contact, and if such fruits are available isolated ones are seldom attacked. Infestation could be reduced by growing early varieties with fruits that are past the tender stage when the third generation occurs and that are well separated and exposed to the sun, the heat being shunned by newly hatched larvae.

It is difficult to reach the larvae with sprays, though in one instance in La Plata a peach orchard was quite free from infestation after 4 applications of lead arsenate in January and February, although adjoining pear and apple orchards were infested. Satisfactory control will have to be effected biologically. The author found the larvae to be parasitised by the Ichneumonids, *Eudeleboea lopezi*, Blanch., and *Hemiteles venturi*, Schrottky, and possibly by *Pimpla behrensiella*, Blanch. [see preceding abstract]. Some of the larvae were infested by a mite of the genus *Tyroglyphus*, and though it did not affect them when they were feeding and left them when they pupated, it killed those that were hibernating, as it fed on their reserve tissues and the losses thus caused were not replaced. The larva of *Chrysopa lanata*, Blanch., preyed on the newly hatched larvae, and a fungus, *Beauveria* sp., destroyed up to 25 per cent. of those in hibernation.

Feytaud (J.) & de Lapparent (P.). **Sur l'emploi de dérivés résiniques et terpéniques dans la préparation d'insecticides.**—*Bull. Inst. Pin* no. 12 reprint 2 pp. Bordeaux, December 1935. [Recd. July 1936.]

As the toxic elements of plants that contain rotenone are known to be soluble in pine oil or commercial terpinolene, the possibility of using

pine products for preparing insecticides from them was investigated. Amounts equal to almost 10 per cent. of the weight of the solvent can be extracted. Sprays of terpinolene emulsified with sulphonated terpenic alcohol injured foliage at concentrations greater than 0·2–1·5 per cent. unless applied in the winter. The necessary concentration of a product containing about 16 per cent. derris extractives (5 per cent. rotenone) for use against the potato beetle [*Leptinotarsa decemlineata*, Say] was found to be 1 lb., 2 lb. and 5 lb. to 100 gals. water against young larvae, mature larvae and adults, respectively. To obtain a spray of suitable concentration, derris or cubé [*Lonchocarpus*] powder (5 per cent. rotenone content) was first steeped for 5 days in terpinolene (15 : 100) at a temperature of 30° [86°F.] and 60 per cent. of the mixture was then combined with 20 per cent. terpineol and 20 per cent. sulphonated oleic alcohol. When sprayed on fourth instar larvae of *Leptinotarsa*, a 0·5 per cent. emulsion killed 30 per cent. in 24 hours, 75 per cent. in 48 hours and 100 per cent. in 4 days. In winter tepid water should be used. The freezing point of the mixture can be lowered by replacing some of the terpineol and oleic alcohol by ammonium sulphoricinate. The mixture is a combined insecticide and wetting agent.

Kozhantschikov (I. W.). **Zur Frage nach dem Temperaturoptimum des Lebens. vi. Ueber die physiologische Bedeutung der Wärmesumme bei Insekten.** [The Question of the Vital Optimum Temperature. vi. On the physiological Importance of the Temperature Sum in Insects.]—*Zool. Anz.* **113** no. 1–2 pp. 7–13, 17 refs. Leipzig, 2nd January 1936.

The work described in this paper was an attempt to account physiologically for the temperature sum [*cf. R.A.E.*, A **23** 296, etc.] in insects. With larvae of *Loxostege sticticalis*, L., the temperature sum and consumption of oxygen were smallest at 30–32°C. [86–89·6°F.]. The amount of digested food was smallest at 24·4°C. [75·92°F.]. With the larvae of *Euxoa* (*Agrotis*) *segetum*, Schiff., the amounts of oxygen and digested food increased, and the minimum totals of the temperature sum occurred at medium temperatures, about 21–25°C. [69·8–77°F.]. In the case of the pupae of these two moths and of *Ephestia kuehniella*, Zell., the medium temperatures (which were also the optima) corresponded to the smallest totals of the temperature sum and of oxygen consumption. For eggs of *E. segetum* the smallest temperature sum occurred at medium temperatures, at which the egg mortality was also lowest. At these temperatures respiration was less intensive. The temperature sum is, therefore, not a constant [*cf. loc. cit.*] and its application for ecological purposes is only possible if the sum is not calculated according to a general formula, but obtained empirically for each particular temperature range.

Die ersten Kartoffelkäferzuflüge im Saarland. [The first Potato Beetle Records in the Saar.]—*NachrBl. dtsch. PflSchDienst* **16** no. 7 pp. 67–68, 3 figs. Berlin, July 1936.

Between 19th and 26th June 1936, 7 males and 5 females of the Colorado potato beetle [*Leptinotarsa decemlineata*, Say] were seen in various localities in the Saar close to the French frontier, the greatest distance being about 4 miles. In two cases eggs were found.

FISHER (R. C.). **Insects attacking the Timber of English Oak.**—*Forestry* **10** no. 1 pp. 47–57, 3 pls., 11 refs. London, June 1936.

Notes are given on insects attacking the wood of oak in England, including general data on the types of injury they cause and on methods of preventing and controlling infestation. They are divided under those attacking growing trees or recently felled logs, and seasoned and old timber. The chief defects caused by insects in the timber of English oaks are summarised in an appendix.

CRANE (M. B.), GREENSLADE (R. M.), MASSEE (A. M.) & TYDEMAN (H. M.). **Studies on the Resistance and Immunity of Apples to the Woolly Aphis** *Eriosoma lanigerum* **(Hausm.).**—*J. Pomol.* **14** no. 2 pp. 137–163, 4 pls., 16 refs. London, July 1936.

The experiments described in this report were carried out between 1922 and 1935 in England in the course of a study of various problems connected with the infestation of apples by *Eriosoma lanigerum*, Hsm. [*cf. R.A.E.*, A **16** 112; **22** 584, etc.]. One of the original objects was to obtain a series of apple root-stocks in which immunity from attack was combined with other desirable characters.

The following is the authors' summary: The life-cycle of *E. lanigerum* is outlined and the hereditary behaviour of the apple in respect of immunity to attack is described and the term "immunity" is defined. An account is given of the entomological technique used in testing for resistance and immunity, and of preliminary physiological investigations on the underlying causes of immunity. A genetical analysis is made of the families raised from crossing established varieties of apples with a number of forms commonly used as root stocks. The seedlings have been derived from susceptible × susceptible, immune × immune, susceptible × immune, immune × susceptible and a few small families from selfing immune and susceptible forms. A total of 3,758 seedlings have been raised, entomologically investigated, and their susceptibility or immunity determined.

It is tentatively concluded that the immunity to attack is determined by and dependent upon a certain balance of genetic factors, and that it is governed by a number of genes the action of which is in part complementary and in part cumulative. A preliminary account is given of the characters of some of the immune seedlings.

PARKER (E.). **Menace of the Heather Beetle. Moors which are being denuded of Food for Grouse.**—*Field* **168** no. 4367 pp. 552–553, 6 figs. London, 5th September 1936.

Since 1911 when attention was first directed to the danger involved in attack by *Lochmaea suturalis*, Thoms., on heather in Scotland, the beetle has spread over wide areas, and in August 1936 a questionnaire was sent to owners of grouse moors asking for information as to whether their moors were infested, the date of infestation, the extent of damage caused and any suggested controls. Extracts are given from letters received in answer, mostly confirming that severe damage has been done. In one case only was the infestation effectively dealt with, the remedies suggested by this correspondent being burning for 15 ft. all round the patch attacked, however large, hacking up the affected part if possible, spraying with kerosene and burning, and spreading naphthalene powder. If burning is done in June–July, no further action appears necessary.

The overwintered beetles first appear in April–May. The eggs are laid in June on sphagnum moss and the larvae ascend neighbouring heather plants and begin to feed. They are full-fed in July and pupate in the peat at the roots of the plants. Adults appear in August–September and at the end of the latter month go into the peat to hibernate.

It is suggested that a Government investigation of the question of control should be made since sheep as well as grouse feed on heather. Possibly the greatest natural enemy of the beetle is black game.

Hukkinen (Y.) & Vappula (N. A.). **Ueberblick über das Auftreten von Pflanzenschädlingen in Finnland i. J. 1935.** [A Survey of the Occurrence of Plant Pests in Finland in 1935.]—*Maataloust. Aikakausk.* **8** no. 2 pp. 115–122, 10 figs., 3 refs. Helsinki, 1936. (With a Summary in Finnish.)

In this report the pests are arranged according to the class of plant they attack. Those not recorded from previous reports [*R.A.E.*, A **21** 213; **23** 516, 517] include: the Halticids, *Phyllotreta vittula*, Redt., and *Chaetocnema mannerheimi*, Gyll., on summer wheat and young winter cereals; the bugs, *Dolycoris baccarum*, L., *Lygus pratensis*, L., and *Miris dolabratus*, L., which were very abundant on ripening wheat; *Haplothrips aculeatus*, F., *Trachea* (*Hadena*) *basilinea*, F., and *Sitodiplosis mosellana*, Géh. (*Clinodiplosis aurantiaca*, Wagn.), which injured the ears of rye; *Bolacothrips jordani*, Uz., which caused "white ear" in *Alopecurus pratensis*, and *Chirothrips hamatus*, Tryb., which sometimes reduced the production of seed in this grass by 70–80 per cent.; *Hypera* (*Phytonomus*) *nigrirostris*, F., and *Tortrix paleana*, Hb., on clover; *Hydroecia micacea*, Esp., on young sugar-beet; *Trioza viridula*, Zett., on carrots; and *Anthonomus rubi*, Hbst., on strawberries. Apple was attacked by *Chrysoclista* (*Blastodacna*) *putripennella*, Zell., which had not previously been known in Finland, and *Rhynchites cupreus*, L., which caused considerable loss by boring into the skin of the unripe fruit.

[Bel'skiĭ (B. I.) & Shaposhnik (I. P.).] **Бельский (Б. И.) и Шапошник (И. П.). Combating the Beet Fly.** [*In Russian.*]—*Nauch. Zap. sakharn. Prom.* **12** no. 2 pp. 91–98, 6 refs. Kiev, 1936.

In the Russian Union, *Pegomyia hyoscyami* var. *betae*, Curt., usually infests weeds and only occasionally becomes abundant on beet. A severe infestation of sugar-beet, however, occurred in May–June 1934 in the part of the Ukraine situated on the right bank of the Dnieper. It was probably due to climatic factors, including a cool wet summer in 1933 that favoured the growth of various weed food-plants and reduced the activity of parasites, and a warm autumn that promoted the development of the 3rd and 4th generations of *Pegomyia*. The warm spring of 1934 induced the mass emergence of the adult flies and intense oviposition, while the lack of rain retarded the growth of weeds, so that the eggs were laid on the beet. The development of the summer generations was, however, checked by parasites, which were very active owing to the warm weather; moreover, heavy rains in June washed the eggs from the leaves.

The flies have been caught in numbers in the baits of fermenting molasses used for Noctuids [see next paper] and such baits are considered of value for control. In tests of sprays to destroy the larvae in

the mines, the most effective insecticide was 57 per cent. barium chloride. Used at concentrations of 5 and 6 per cent. at a mean temperature of 17·9°C. [64·22°F.] and an average humidity of 57 per cent., it killed or expelled from the mines a total of 79 and 89 per cent. of the larvae respectively. Sodium arsenite (at concentrations of 0·09 and 0·10 per cent.) was a little less effective at this humidity, but when the humidity was lower (49 per cent.) and the temperature almost the same the effectiveness of the sprays was increased, so that 5 per cent. barium chloride and 0·09 per cent. sodium arsenite both accounted for 88 per cent. of the larvae. Sodium fluoride and sodium fluosilicate were considerably less satisfactory, and if sprays are applied against the beet weevil [*Cleonus punctiventris*, Germ.] and the larvae of *P. hyoscyami* simultaneously, these compounds should be replaced by barium chloride, provided that the air humidity is not high. They are of value, however, in sweetened bait-sprays against the adult flies and if so used will also kill the weevils.

[Bel'skiĭ (B. I.).] **Бельский (Б. И.). On the Technique of catching injurious Noctuids with Molasses.** [*In Russian.*]—*Nauch. Zap. sakharn. Prom.* **12** no. 2 pp. 99–107, 10 refs. Kiev, 1936.

Baits of fermenting molasses in large shallow wooden basins are extensively used in the Russian Union to catch the adults of *Euxoa segetum*, Schiff., and other Noctuids, and in 1932–34 field experiments were carried out in the Ukraine to find improvements in this method of control. As the moths are not attracted to the bait in the presence of flowering crops or weeds, the position of the containers in or near sugar-beet fields should be determined in each individual case. The radius of the action of the bait [*cf. R.A.E.*, A **17** 6] varied according to the weather and environment. If the containers were on stands at a height of 3 ft., the baits caught the low-flying females with fully developed eggs as well as the sexually immature ones, which fly high. Tests with different types of pans showed that many more moths were caught, because they were unable to escape, if the walls were smooth and vertical and there were no angles. The maximum absolute catch of the adults of all species of Noctuids was in the standard type of basin, but when the exposed surface of the molasses or the quantity contained in the receptacle was taken into consideration, a quart bottle without a bottom fixed upside down on a pole proved to be the most effective. This was partly due to the smoothness of the glass walls and partly to the fact that the molasses in the bottle fermented more rapidly than in the thin layer in the basin. It appeared that a distance of 4 ins. from the edge of the pan to the surface of the molasses is the optimum.

In other experiments, a poison was added to the molasses, and it is concluded from the results that this should always be done if the containers used are of a type from which many of the moths can escape. Of the poisons used, sodium arsenite at a concentration of 0·05 per cent. retarded fermentation of the molasses, but sodium fluoride at less than 0·4 per cent. and an anabasine sulphate and nicotine sulphate at any concentration tested did not hinder it. The relative efficiency of these poisons was not constant during the three years' tests; on the whole sodium fluoride (0·25 per cent.) appeared to be the best, though in individual tests sodium arsenite (0·05 per cent.) and anabasine sulphate (1 per cent.) were superior to it. The attractiveness of the baits was

increased by the addition of a few drops of amyl acetate. Devices that exposed the poisoned molasses by means of a wick [*cf.* **10** 482] did not prove so effective as the standard containers.

[Negrash (K. A.).] **Неграш (К. А.). On the Rôle of Strips of Beet as Traps for the Control of the Beet Weevil in 1928–1930.** [*In Russian.*]—MS. in Lib. All-Un. sci. Inst. Sugar Ind. [Kiev] 23 pp. (Abstr. in *Nauch. Zap. sakharn. Prom.* **12** no. 2 pp. 111–112, 3 refs. Kiev, 1936).

In the course of an outbreak of the beet weevil [*Cleonus punctiventris*, Germ.] in 1928–30 in the Department of Kiev, strips of beet of inferior quality were sown in spring at the borders of new beet fields to trap the overwintered weevils that migrate from the beet fields of the preceding year. The results, apart from the increased cost of the work, did not justify this method of control, as in 1928, when the weevils were unusually abundant, they destroyed the strips completely before the main crop sprouted, so that it was not safeguarded, and in 1929 and 1930 the average numbers of weevils collected per acre on the strips and on the fields were practically equal.

[Korab (I. I.) & Shaposhnik (I. P.).] **Кораб (И. И.) и Шапошник (И. П.). Fitness of different Fluorine and Arsenate Preparations to combat Beet Weevil.** [*In Russian.*]—*Nauch. Zap. sakharn. Prom.* **12** no. 3 pp. 67–73, 4 graphs, 2 refs. Kiev, 1936.

A brief account is given of tests in Russia with arsenical and fluorine compounds as dusts and sprays against *Cleonus* (*Bothynoderes*) *punctiventris*, Germ. The sprays were also compared with barium chloride. The weevils were either fed on pieces of treated beet leaf in the laboratory, or confined by lamp glasses in batches of 5 on small treated beet plants. In all tests the fluorine compounds were much more toxic than the arsenicals, and as sprays were equal or superior to barium chloride; moreover they caused little or no injury to the beet, which was severely scorched by calcium arsenite and sodium arsenite. Sodium fluosilicate was definitely more effective than potassium fluosilicate or sodium fluoride, which differed little from each other. It was also found that the weevils destroy a much smaller area of leaves treated with fluorine compounds than of those treated with arsenicals.

Ullyett (G. C.). **The physical Ecology of *Microplectron fuscipennis*, Zett. (Hym. Chalc.).**—*Bull. ent. Res.* **27** pt. 2 pp. 195–217, 13 figs., 19 refs. London, July 1936.

An account is given of the technique and results of a laboratory study of the reactions to climatic factors of *Microplectron fuscipenne*, Zett., which is an important parasite of *Diprion sertifer*, Geoff., in Europe and has been introduced into Canada for the control of *D. polytomus*, Htg., on spruce [*cf. R.A.E.*, A **23** 747]. *D. sertifer* was used as the host. The following is the author's summary: The influence of atmospheric humidity on the various stages in the life-cycle of *M. fuscipenne* is examined. Both the longevity of the adults and the extent of oviposition are found to be proportional to the saturation deficiency of the atmosphere. Under favourable temperature conditions, functional activities are at their maximum in a moist climate,

but a wide tolerance is exhibited so far as oviposition is concerned. At normal humidities no effect on the developmental period of the parasite is apparent when the humidity is varied, and this is shown to be due to the protection afforded by the host cocoon.

Temperature affects the parasite in a normal manner. The threshold of development is approximately at 8·3°C. [46·76°F.], and the zone of functional activity is from 15° to a little over 35°C. [59–95°F.]. Optimum conditions for oviposition and development occur between 20° and 35°C. [68–95°F.]. Death occurs at 40°C. [104°F.], while at the lower temperatures, near freezing point, starvation of adults takes place after a lengthy exposure. The hibernating parasite can withstand temperatures very much below freezing point, field records coming from countries where the winter temperature falls to so little as −37°C. [−34·6°F.].

The relation of *Microplectron* to climate is discussed, and an explanation is offered of the wide variation in natural parasitism occurring in European countries [*loc. cit.*]. The actual and possible distributions of the parasite in Europe are discussed, and a map is presented depicting the position as known at present. The possible distribution of the parasite in North America, after liberations have been made, is dealt with, and it is shown that the present trend of dispersal of *Diprion polytomus* is in the direction of climatic conditions that are more favourable to the parasite than are those in the area where the parasite has already become established.

Parsons (F. S.) & Ullyett (G. C.). **Investigations of *Trichogramma lutea*, Gir., as a Parasite of the Cotton Bollworm, *Heliothis obsoleta*, Fabr.**—*Bull. ent. Res.* **27** pt. 2 pp. 219–235, 5 graphs, 9 refs. London, July 1936.

An account is given of an investigation begun in South Africa in 1930 and carried on for 4 years on experimental releases of *Trichogramma luteum*, Gir., an indigenous parasite of the eggs of *Heliothis armigera*, Hb. (*obsoleta*, F.), after it had been reared in numbers in the laboratory [*cf. R.A.E.*, A **21** 157; **22** 255]. Problems involved in the estimation of parasitism in populations of eggs of *H. armigera* are discussed. It is shown that the value of egg parasites depends upon the extent to which they parasitise that portion of the eggs that would hatch under natural conditions after the deduction of infertile eggs and those that would be destroyed by other factors. As eggs 48–60 hours old may be parasitised to the extent of 70 per cent., whereas only a few of those 24 hours old may be parasitised, estimates of parasitised eggs should be based only on eggs of known age in the surviving fraction, and values must be sought for them in comparative computations of resulting larvae.

The habits of ovipositing females of *H. armigera* in respect of duration of oviposition on individual crops and diversion from one food-plant to another are discussed in relation to releases of *T. luteum*, and data are given on the distribution of bollworm eggs in a crop [*cf.* **22** 225; **24** 279, 442]. Crops require to be selected carefully for purposes of testing *T. luteum*, both with regard to their flowering periods and juxtaposition of other crops. Investigations on the dispersion of liberated parasites are described. Parasites at the rate of 5,000 per acre were allowed to escape from containers placed in the centre of each field when oviposition of the host was abundant. Dispersion was found

to be rapid and widespread. No central concentration of parasitised eggs was shown in cotton or maize, though relatively dense grouping sometimes occurred towards one side of a field or at different points in it. The concentration coincided with areas of heavier oviposition. In irrigated bean crops eggs of *Heliothis* were evenly distributed and concentration of parasitism occurred about the point of liberation, although dispersion in all directions was shown. When liberations at the rate of 10,000 to the acre were made in irrigated bean crops parasitism in the concentrated area attained 80 per cent. of the recorded eggs.

The following is taken from the authors' summary : From a typical experiment in rain-grown maize, the percentages of parasitism recorded in a large number of equal sections of the crop are regressed on proportionate larval survival. Although the egg parasitism ranged from 21·2 to 82·3 per cent., differences in larval populations were inappreciable. An explanation for this is offered in an analysis of the effect of various mortality factors. The parasite was relatively ineffective in cotton crops. The low degrees of parasitism found are assigned to the growth habit of the plant, the scattered manner of egg deposition thereon and the impediment offered by the dense hair processes of the plant at many sites where eggs are commonly placed. Investigations on irrigated (cool season) market-garden crops and *Citrus* orchards are also described. Oviposition of *H. armigera* is extensive and sustained for 3–4 months on these crops, thereby affording opportunity for continuous parasite activity and the cumulative participation of progeny bred in the field. In nature, however, *T. luteum* does not appear until the latter end of the egg-laying by *H. armigera* and the authors were unable to establish laboratory-bred representatives at an earlier period.

Another egg parasite, *Phanurus ullyetti*, Nixon, is prevalent before *T. luteum* appears and accomplishes much that was hoped for from the attempted earlier introduction of the latter. In effect *T. luteum* becomes substituted for *P. ullyetti* towards the close of the winter season. It is probable that temperature is a determining factor in the biology of both parasites, although other causes for the observed relations are suggested. The developmental period of *P. ullyetti* is usually 2 weeks and only 1 adult emerges from a host egg, whereas *T. luteum* commonly develops in a week and 2–3 or more adults emerge from each host egg. It is thus possible that *T. luteum* may practically eliminate *P. ullyetti* from eggs of *Heliothis* in the spring and summer months.

Bebbington (A. G.) & Allan (W.). **The Food-cycle of** *Dysdercus fasciatus* **in Acacia Savannah in Northern Rhodesia.**—*Bull. ent. Res.* **27** pt. 2 pp. 237–249, 10 figs., 4 refs. London, July 1936.

The following is the authors' summary :—A study of the variations of the population of *Dysdercus fasciatus*, Sign., on cotton and on its wild host plants is described [*cf. R.A.E.*, A **22** 680, etc.]. The most important host of *D. fasciatus* in the *Acacia* savannah of Northern Rhodesia is *Thespesia rogersi*, and it is shown that at certain times a general flighting of stainers takes place from this host plant, caused by food shortage or defoliation. Generally a period of food shortage occurs during the earlier months of the year, owing to rotting of the old crop and extensive destruction of the early new crop by the larvae of a Cossid. This causes an early influx into cotton, which leads to the

establishment of a large population in the field at a critical period in the development of the bolls. When the early crop is retained on the trees, a continuously increasing food supply is provided, and this first movement does not take place. A second movement from *Thespesia*, which is largely due to defoliation, begins generally in June. It has been shown that a second influx into cotton coincides with this later movement from *Thespesia*. A late influx such as this is of little practical importance, since the greater part of the crop is picked in May and June. The observations recorded indicate clearly that the movement of *D. fasciatus* into cotton is not due to any attraction exercised by the crop, but is caused by a forced movement of stainers from *Thespesia rogersi*.

China (W. E.). **A new Species of** *Cicadulina*, **China (Homoptera, Jassidae) injurious to Maize in Tanganyika Territory.**—*Bull. ent. Res.* **27** pt. 2 pp. 251–252, 1 fig. London, July 1936.

In attempting to breed strains of *Cicadulina zeae*, China, capable of transmitting the virus of streak disease of maize, H. H. Storey made certain crosses that showed conclusively the existence of a second species, which is here described from males from maize in Tanganyika as *C. storeyi*, sp. n. The characters distinguishing *C. storeyi* from *C. zeae*, which it closely resembles, and from *C. similis*, China, are given.

Marshall (Sir G. A. K.). **Curculionidae (Col.) attacking cultivated Plants.**—*Bull. ent. Res.* **27** pt. 2 pp. 253–259, 2 figs. London, July 1936.

The following new species are described: *Protostrophus armatipes* and *P. cerealis*, attacking young wheat, and *P. sorghi*, attacking young *Sorghum*, in South Africa; *Apion corchori* and *Colobodes dolichotis*, bred from stems of the jute plant (*Corchorus*) and *Dolichos lablab*, respectively, in Madras; and *Baris amaranthi* and *B. dodonis*, from roots of native spinach (*Amarantus polygamus*) in Uganda.

Apion (*Piezotrachelus*) *ugandum*, Wagn., is recorded as a very serious pest of bambarra ground-nut (*Voandzeia subterranea*), a most important food-crop in the Bukoba district, Tanganyika Territory. The adults are found in the soil round the collar of the plants, and oviposition takes place when the nuts are well-formed and beginning to harden. The interior of the pods is reduced to a brown faecal mass. As the crop is planted in September and reaped the following March, the weevil must carry over on some other crop from March until September. The natives believe that attack is worst in years of heavy rainfall. *Alcides obsoletus*, Gerst., is recorded from Kenya as a pest of *Crotalaria juncea*. This weevil was first recorded from near Mombasa and is known to occur in Nyasaland, Portuguese East Africa and the south-east of Southern Rhodesia.

Ferrière (C.). **Two new Egg-parasites of** *Batocera* **(Col., Lamiid.) in Malaya.**—*Bull. ent. Res.* **27** pt. 2 pp. 331–333, 3 figs. London, July 1936.

Descriptions are given of the Cleonymid, *Louricia ovivora*, gen. et sp. n., and the Encyrtid, *Ooencyrtus batocerae*, sp. n., which are egg parasites of *Batocera rubus*, L., in Malaya.

EDWARDS (W. H.). **Pests attacking *Citrus* in Jamaica.**—*Bull. ent. Res.* **27** pt. 2 pp. 335–337. London, July 1936.

A list is given of the pests that have been found to attack *Citrus* in Jamaica, in view of the steps that are being taken to extend and organise the cultivation of the fruit for export. The Coccids recorded are *Coccus viridis*, Green, *Lepidosaphes beckii*, Newm., and *Chrysomphalus ficus*, Ashm. (*aonidum*, auct.), which are on the whole the most injurious, and *Orthezia insignis*, Dougl., *Pseudococcus citri*, Risso, *Pulvinaria psidii*, Mask., *Ceroplastes ceriferus*, And., *Coccus hesperidum*, L., *Saissetia coffeae*, Wlk. (*hemisphaerica*, Targ.), *S. oleae*, Bern., *Prontaspis* (*Chionaspis*) *citri*, Comst., *Selenaspidus articulatus*, Morg., *Aonidiella* (*Chrysomphalus*) *aurantii*, Mask., *Parlatoria pergandei*, Comst., and *P. zizyphus*, Lucas. The larvae of the weevils, *Prepodes vittatus*, L., and *Pachnaeus litus*, Germ., attack the roots and sometimes cause considerable damage, especially in young plantations. *Aleurocanthus woglumi*, Ashby (citrus blackfly) is now completely controlled by *Eretmocerus serius*, Silv. [*cf. R.A.E.*, A **22** 66]. *Solenopsis geminata*, F., causes injury by chewing the bark and tender tissue of young shoots and by fostering *C. viridis*, which is also spread by *Cremastogaster brevispinosa*, Mayr. *Nezara viridula*, L., has been recently observed in large numbers in groves where leguminous plants had been grown, causing young buds and shoots to wilt rapidly. *Papilio cresphontes*, Cram., and *P. pelaus*, F., and the bagworm, *Oeceticus* (*Oiketicus*) *abbotti*, Grote, rarely occur in destructive numbers. Outbreaks of Aphids frequently cause dwarfing of young shoots, and thrips and mites infest fruit produced in the drier areas. No single species has been of outstanding importance, because *Citrus* is usually grown in mountainous districts, where the pests are localised by the varying ecological conditions, and there are few large groves, the trees being scattered among rank vegetation or in pasture. In several districts the climate inhibits the multiplication of Coccids. A brief outline is given of the necessary precautions to be observed as the cultivation of *Citrus* is developed.

HARGREAVES (H.). **Variegated Coffee Bug (*Antestia* spp.) in Uganda.**—*E. Afr. agric. J.* **1** no. 6 pp. 448–452, 2 refs. Nairobi, May 1936.

A description is given of the history in Uganda and of the stages of the Pentatomids of the genus *Antestia*, which are serious pests of coffee. Two species, *A. lineaticollis*, Stål, and *A. faceta*, Germ., occur in the Protectorate, but not in the same districts. They were formerly regarded as varieties of a single species, but are now considered distinct, on account of failure of attempts to interbreed them. They are similar in appearance and life-history, however, and are here discussed as one. The eggs hatch in 4–9 days, and the final (fifth) moult occurs 7 weeks later. The female may start to oviposit 8 days after the final moult, and lays a cluster of eggs every 3 or 4 days. One individual may lay over 300 eggs in 20 weeks, and adults sometimes live for 8 months. In warm sunshine they readily use their wings when disturbed.

Feeding on the coffee berry is essential for reproduction, and egg-laying is most prolific during the first four months of the development of the berry, when the bean tissues are soft. Damaged beans are spotted or irregularly shaped, and occasionally become shrivelled and

useless. In one area the bug appears to have been responsible also for the introduction of bean rot (probably *Nematospora*). The only food-plants recorded in Uganda besides *Coffea arabica* are three species of *Canthium*.

Two egg-parasites, *Microphanurus seychellensis*, Kieff., and *Hadronotus antestiae*, Dodd, assist considerably in the natural control of *Antestia*. Both also attack the eggs of *Agonoscelis versicolor*, F., which feeds on *Leonotis africana*, a weed that helps to preserve them when no *Antestia* eggs are available. A Tachinid, *Epineura rubens*, Villen., which parasitises the adult bugs, is considered of little importance. Predacious enemies include a Mantid and several species of ants.

Hand collection of the bugs in dull weather [*R.A.E.*, A **20** 546; **24** 111], with the assistance of smoke [**13** 352], sometimes gives sufficient control and has the advantages that it costs relatively little, can be carried out in wet weather, and does not injure the natural enemies. A bait-spray of 2 oz. sodium arsenite, 2 lb. sugar or jaggery and 4 gals. water [*cf.* **23** 70], applied upwards into the middle of the tree by means of an atomiser three times at weekly intervals in dry weather before flowering is due, reduces infestation rapidly and at a low cost. It is, however, liable to destroy beneficial insects and, if carelessly used, to scorch the foliage. It can be applied only during suitable weather, and, where crop is present, after the coffee beans have hardened. The value of an atomised kerosene-pyrethrum spray [**23** 143, etc.] is discussed. High cost, the variable quality of pyrethrum and the danger of scorching will probably prevent its employment in Uganda, where results have not been so satisfactory as in Kenya, but it will be useful to test the density of bug population. Soap emulsion of kerosene extract of pyrethrum has been advocated for wetter districts [**21** 302]. The cost of this is slightly less, but a high pressure sprayer must be used and the spray must actually wet the bugs. A combination of bait-spraying and hand collection is likely to prove the most suitable procedure in Uganda.

In a footnote, reference is made to an article on the use of pyrethrum dust against *Antestia* [**24** 240] published since this paper was written.

STOREY (H. H.). **Virus Diseases of East African Plants : V.—Streak Disease of Maize.**—*E. Afr. agric. J.* **1** no. 6 pp. 471–475, 4 figs., 5 refs. Nairobi, May 1936.

Streak disease of maize occurs in East Africa wherever the climate is suitable, being prevalent on the coastal plains and in Uganda but very seldom met with in the highlands. It occurs also in many other parts of Africa, even as far north as Egypt. The primary effect of the disease is a variegation of the young leaves, which develop chlorotic streaks along the veins. There are practically no secondary effects if the plant is infected just before flowering, but if it is infected when young it remains severely stunted, develops few lateral roots, and probably sets no seed. The disease cannot be transmitted by inoculation nor carried in the seed, but it is spread by Jassids of the genus *Cicadulina*. The most important vector is *Cicadulina mbila*, Naudé [*R.A.E.*, A **14** 18], in addition to which there are at least two others, *C. zeae*, China, and a recently described species [*C. storeyi*, China (**24** 647)]. *C. mbila*, and probably the others also, occur in two races, one able, and the other unable, to transmit the virus [**20** 717; **24** 187, etc.]. On emerging from the egg all insects are free from the virus.

Those of a suitable race may acquire it by feeding on the chlorotic portion of an infected leaf, become themselves infective in a day or two, and remain so through several months. They may infect a plant by feeding on any part of it above ground. Damage is not apparent at the place attacked, but only on the young leaves that open later. The distribution of the Jassids appears to be markedly controlled by climatic factors ; they are most prevalent on the coastal plain and rare at higher altitudes. *C. mbila* disappears first in the progression. Several varieties of sugar-cane and some 20 wild grasses show symptoms resembling streak disease, but it is doubtful whether many of the plants act as alternative hosts for the maize virus [**19** 134] ; certainly sugar-cane does not. Streak disease may be confused with "stripe," which has variable symptoms, sometimes resembling streak so closely that the only means of identification is by insect-transmission experiments [**24** 286]. The best line of control lies in the extension of the period between crops to its maximum length, the destruction of any self-sown plants that may grow after the crop is harvested, and the avoidance of a succession of sowings over a long period in the same district. No naturally immune varieties of maize are known, and there is no likelihood that any kind of artificial immunisation could be effective.

HARRIS (W. V.). **Notes on two injurious Psyllids and their Control.**—*E. Afr. agric. J.* **1** no. 6 pp. 498–500, 4 figs. Nairobi, May 1936.

Brief descriptions are given of two Psyllids injurious in Tanganyika, *Phytolyma lata*, Wlk., and *Trioza* (*Spanioza*) *erythreae*, Del G. The latter, of which *Trioza merwei*, Pettey, is a synonym, occurs down the east coast of Africa from Eritrea to the Cape. Its natural food-plants all belong to the family Rutaceae and it causes serious injury to *Citrus*. The female oviposits on the young shoots, the eggs hatch in 5–6 days, and the nymphs settle on the underside of the leaves. A pit develops if the tissue is young enough and enlarges with the growth of the nymph. The nymphal stage lasts 2–3 weeks. This Psyllid breeds all the year round and is injurious at any time when there is a supply of tender foliage. If the number of pits is large the leaf becomes crumpled and unsightly. Spraying with oil emulsion at fortnightly intervals, while the flush of young foliage continues, is recommended to kill the young nymphs, but is only justified in the case of nursery stock. The eggs are thought to be resistant to sprays.

P. lata causes new shoots on young trees of *Chlorophora excelsa* to develop into galls instead of normal foliage, and the trees, which are being planted for timber in new areas, grow stunted and frequently die [*cf. R.A.E.*, A **20** 582]. The eggs are laid on young tissues, usually buds, and the nymphs hatch after about 8 days. They settle on the leaf, and the feeding punctures stimulate the rapid growth of gall tissue, which forms a cell enclosing the bug. Under experiment, gall formation started 10 days after the liberation of the adult Psyllids. When infestation is dense, large multiple galls may be formed. The nymphs are parasitised by at least two species of Chalcidoids [*cf.* **19** 378]. Spraying of nursery stock in the field with oil emulsion at intervals of 10 days during 1935 prevented most of the gall formation, from which it would appear that the eggs are not so resistant to spray as those of *T. erythreae*. The formula used was 4 gals. lubricating oil, 1½ gals. oleic acid, 2 lb. sodium hydroxide and 100 gals. water. For preparing the stock, the oil and oleic acid were mixed and added to a

solution of the soda in 10 gals. water. The rather large amount of emulsifying agents ensured the stability of the emulsion and made it suitable for use by natives.

MASSEE (A. M.). **Notes on some interesting Mites and Insects observed on Hops and Fruit Trees in 1935.**—*Rep. E. Malling Res. Sta. 1935* **23** pp. 164–170. East Malling, Kent, May 1936.

It has now been established that in Kent *Tetranychus telarius*, L., begins to infest the bines and feed on tender growth of hops in the early spring; in 1935 it appeared at the end of April. A proprietary pyrethrum spray, combined with sulphonated lorol wetting preparation and applied in the first week of May to the bines and poles up to a height of 8 ft., practically eradicated the mites in a hop garden that had been infested for several years and where females had been very numerous in April.

Insect pests observed in Kent during the year included: *Macrosiphum* (*Myzus*) *festucae*, Theo., which caused considerable damage to winter oats; *Anuraphis roseus*, Baker, and *Aphis pomi*, DeG., on apple; *Phorodon humuli*, Schr., *Hyalopterus arundinis*, F., and *Anuraphis padi*, L., on plums; *Zeuzera pyrina*, L., which was recorded for the first time from black currant; the Tineid, *Solenobia inconspicuella*, Staint., larvae of which were found feeding on apple twigs, their normal food being lichen growing on fences and tree-trunks; *Cydia* (*Laspeyresia*) *funebrana*, Treit., which appears to be rapidly establishing itself in a large plum area; *Hepialus humuli*, L., which attacks the roots of hops, and strawberries when planted after them; *Ledra aurita*, L., which normally feeds on oak but attacked apple leaves in a derelict orchard; *Thomasiniana oculiperda*, Rübs., which caused damage to newly budded apple stocks, but can be controlled by coating the buds with petroleum jelly immediately after they are tied; and *Lucanus cervus*, L., larvae of which were found in the roots and stem of a cherry tree.

Caliroa (*Eriocampa*) *limacina*, Retz., was very prevalent locally on cherries, appearing after spraying operations were finished and causing much damage and defoliation. The young larvae can be easily controlled by insecticides. *Hoplocampa flava*, L., was practically exterminated in a plum orchard that had been heavily infested for a number of seasons, by a frost on the night of 16th–17th May, which destroyed most of the plum crop. *H. testudinea*, Klug, on apple was less affected, as its oviposition period is somewhat later. The almost complete destruction of the apple crop in some districts, however, is likely to reduce its numbers. The adults that were on the wing after the night of the frost concentrated on the few trees likely to bear fruit.

Severe outbreaks of Scolytids occurred on fruit trees during 1935 in various localities in Kent and Sussex, when the theory that unhealthy trees were more susceptible to attack was disproved. The species concerned were *Xyleborus* (*Anisandrus*) *dispar*, F., *X. xylographus*, Say (*saxeseni*, Ratz.), *Scolytus mali*, Bech. (*pruni*, Ratz.), and *S. rugulosus*, Ratz., all on damson and plum and *X. dispar* on apple. If few trees are infested they should be removed; if the attack is widespread, spraying the trunks with a 10 per cent. tar distillate in April kills some of the adult beetles before they emerge from their galleries.

Cydia pomonella, L., has been growing increasingly injurious in England over the past 8 years. Although numerous in 1934, which

was a glut year, it was overlooked because mainly present in windfall apples for which there was no demand. The hibernating larvae were consequently extremely abundant in the winter of 1934–35 and the ensuing infestation was correspondingly heavy. It is not known whether *C. pomonella* will continue to be a formidable pest or will almost die out as it did 10 years ago. It is suggested that variable weather conditions account for the increase or decrease of this moth.

Several Anthocorids and Lygaeids are recorded from corrugated cardboard bands removed from apple trees in October ; some of them are probably predacious on the fruit-tree red spider [*Paratetranychus pilosus*, C. & F.].

MASSEE (A. M.). **Studies on the Transmission of the Strawberry Virus " Yellow-edge " Disease by Insects. II. Aphid Transmission Experiments and Period of Infectibility.**—*Rep. E. Malling Res. Sta. 1935* **23** pp. 171–176, 2 refs. East Malling, Kent, May 1936.

Further experiments on the transmission of " yellow-edge " disease of strawberries by *Capitophorus potentillae*, Wlk. (*fragaefolii*, Ckll.) were made in Kent in 1935 in a similar manner to those of 1933–34 [*R.A.E.*, A **23** 290], the results of which they confirmed. Transmission of the virus by *C. potentillae* was made during May, June and July, the months when the Aphids were breeding most freely. Of the 30 plants used in each experiment, 10 were infested with Aphids from infected plants, 10 with those from healthy plants and 10 were left as controls. Only 5 Aphids were transferred to the plant to be infested, whether they established themselves or not. After a month the colony of Aphids formed was killed off by the application of nicotine sprays. The only other insects observed on the plants were *Rhynchites germanicus*, Hbst., a minor outbreak of which occurred on some of the plants, and Coccinellids.

Complete surveys of the plants were made in June, August and October. In the plants infested with Aphids from infected plants virus symptoms began to appear 7 weeks after the Aphids were transferred. The series receiving Aphids from healthy plants proved just as vigorous as the control plants, suggesting that Aphids alone cause little injury to the plants beyond leaf curling.

Attempts to transmit the virus by means of *Tarsonemus pallidus*, Banks, again gave negative results.

GREENSLADE (R. M.), MASSEE (A. M.) & THOMAS (F. J. D.). **Studies of Impregnation of Tree Banding Materials. II. Apple Blossom Weevil and Codlin Moth Experiments in 1935.**—*Rep. E. Malling Res. Sta. 1935* **23** pp. 177–183, 1 ref. East Malling, Kent, May 1936.

In 1935, further experiments in Kent on the use of impregnated corrugated cardboard bands on apple trees for trapping the apple blossom weevil [*Anthonomus pomorum*, L.] and larvae of the codling moth [*Cydia pomonella*, L.] confirmed the results of 1934 [*R.A.E.*, A **23** 427], as the same treatments were the most successful. The materials tested included chlorinated naphthalenes (Seekay waxes), dissolved in trichlorethylene, beta-naphthol (37 per cent. in lubricating oil), and tetrachlorobenzene (7 per cent. in trichlorethylene), none of which

injured the trees. Some of the compounds, including the tetrachlorobenzene, were very attractive to the weevils, but bands treated with beta-naphthol were attractive to the codling moth larvae while repelling the weevils. A preliminary experiment on the use of bands impregnated with organic thiocyanates showed that these damaged the trees considerably, and repelled most insects.

Two parasites of the codling moth larvae were reared, the Tachinid, *Arrhinomyia tragica*, Mg., and the Ichneumonid, *Ephialtes crassiseta*, Thoms. Both species appeared to be local.

GREENSLADE (R. M.). **A Note on the Treatment of dormant Nursery Stock against Woolly Aphis.**—*Rep. E. Malling Res. Sta. 1935* **23** pp. 184–185, 1 ref. East Malling, Kent, May 1936.

Experiments were carried out to determine what concentrations of tar distillate dipping solutions and of hydrocyanic acid gas, which are commonly used against *Eriosoma lanigerum*, Hsm., on dormant apple rootstocks, are injurious to the latter. Early and late bud-breaking varieties were used. Bundles of 10 stocks of each type were dipped for 20 seconds into various solutions, including tar oil wash at 10, 20, 25 and 50 per cent., the recommended concentration being 10 per cent. They were then drained for 10 minutes, roots upward, and planted out the following day. The growth of treated stocks of early varieties was retarded by the higher concentrations of the wash, but after 3 months all except those treated with 50 per cent. tar oil were indistinguishable from the controls. All the stocks of the late type developed in the same way as the controls, except that those treated with 50 per cent. tar oil remained slightly stunted. Fumigation was carried out in a small box, in which a temperature of approximately 12°C. [53·6°F.] was maintained, and the air was kept moving by a small fan. The gas was generated from sodium cyanide and sulphuric acid used in amounts representing 4, 8, 16 and 32 oz. sodium cyanide per 1,000 cu. ft., the recommended strength being 2 oz. per 1,000 cu. ft. At each concentration, 20 stocks of each type, 10 comparatively dry and 10 previously sprayed with water, were placed in the box in a raised position and left for 2½ hours. All the stocks behaved in the same way as untreated control stocks.

SUBKLEW (W.). **Experimentelle Untersuchungen über die Bekämpfung der Maikäferengerlinge mit Kalidüngemitteln.** [Experimental Investigations on the Control of Larvae of *Melolontha* spp. with Potash Manures.]—*Anz. Schädlingsk.* **12** no. 6 pp. 65–67, 2 refs. Berlin, June 1936.

Various reports of the more or less successful control of the larvae of *Melolontha melolontha*, L., and *M. hippocastani*, F., by means of potash manures led to experiments in Prussia in 1934–35, the results obtained in the open being completed by laboratory work.

In respect of their action of extracting water from the larvae, the bases were, in order of decreasing effectiveness, K, Na and NH_4, and the chlorides of potassium, sodium and ammonium are the active components of a manure to be used against the larvae. In order of decreasing effectiveness the potash salts were potash 50 per cent., potash 40 per cent., and kainit. Potash magnesia and potassium sulphate were ineffective.

The eggs and larvae were very resistant to pure solutions of potash salts. Kainit reduced the number of larvae, but to keep them down in forests the large quantity of kainit required would be too costly and likely to harm the plants. It is concluded that the use of potash salts against Melolonthid larvae does not appear to be justified, but that observations on the favourable action of such salts are worth investigating.

SOKANOWSKY (B.). **Material zum Studium der Parasiten von Waldschädlingen.** [Material for the Study of Parasites of Forest Pests.] —*Anz. Schädlingsk.* **12** no. 6 pp. 73–74. Berlin, June 1936.

In view of the scanty information available regarding Hymenopterous parasites of forest pests in Russia the following records are given : *Eurytoma ischioxanthus*, Ratz., *Cheiropachys colon*, L., *Dinotus bidentulus*, Thoms., *Callimome bohemani*, Thoms., and *Caenacis* sp. from *Hylesinus* (*Leperisinus*) *fraxini*, Panz. ; *Rhoptrocerus* (*Pachyceras*) *xylophagorum*, Ratz., *Heydenia pretiosa*, Först., *Metacolus unifasciatus*, Thoms., and *Dinotus* sp. from *Ips acuminatus*, Gyll. ; *R. xylophagorum* from *Ips* (*Pityogenes*) *chalcographus*, L. ; *Odontomerus pinetorum*, Thoms., from *Spondylis buprestoides*, L. ; *R. xylophagorum*, *Rhopalicus azureus*, Ratz., and *Dinotus clypealis*, Thoms., from *Ips* (*Pityogenes*) *monacensis*, Fuchs ; *Dendrosoter protuberans*, Nees, which is a parasite of the larvae of *Myelophilus* (*Blastophagus*) *minor*, Htg., and *M.* (*B.*) *piniperda*, L., and was observed piercing an adult of the former with its ovipositor ; *Ecphylus* (*Sycosoter*) *lavagnei*, Pic. & Licht., from *Hypoborus ficus*, Er. ; *R. xylophagorum* and *D. clypealis* from *Polygraphus punctifrons*, Thoms. ; *Rhaphitelus maculatus*, Wlk., from *Scolytus rugulosus*, Ratz. ; *Rhopalicus maculifer*, Först., from *Ips typographus*, L. ; *Perniphora robusta*, Ruschka, from *Xyloterus lineatus*, Ol. ; *Trigonoderus* sp. from *Parmena balteus*, L. ; *Monodontomerus obsoletus*, F., from *Malacosoma neustria*, L. ; *Psychophagus* sp. from *M. neustria* and *Stilpnotia salicis*, L. ; *Eulophus stramineipes*, Thoms., and *Chrysocharis* sp. from *Lithocolletis populifoliella*, Tr. ; and *Ootetrastichus* sp. from the Braconid, *Atanycolus denigrator*, L.

SCHWERDTFEGER (F.). **Mohn, Senf und Buchweizen als Engerlingsbekämpfungsmittel.** [Poppy, Mustard and Buckwheat as Means for combating Melolonthid Larvae.]—*Anz. Schädlingsk.* **12** no. 6 p. 76. Berlin, June 1936.

Laboratory and field experiments in Prussia, made to check the findings of other workers [*cf. R.A.E.*, A **20** 494 ; **21** 204, 324], indicate that poppies, white mustard and buckwheat, grown prior to or intermingled with pines, are of no practical value in protecting the pines against the larvae of *Melolontha melolontha*, L., and *M. hippocastani*, F.

STELZNER (G.). **Ueber die Schädigung der Körnerernte durch den Pferdebohnenkäfer** (*Bruchus rufimanus*). [On the Injury to the Seed Crop by the Horse Bean Beetle, *B. rufimanus*.]—*Z. PflKrankh.* **46** no. 8 pp. 353–358, 2 figs. Stuttgart, 1936.

Owing to climatic conditions in Germany in recent years, infestation of horse beans by *Bruchus rufimanus*, Boh., has been increasing. The adults that have hibernated in the field or have emerged from seeds

after sowing collect on the food-plant, feeding on the leaves and, later, on the blossoms without doing any appreciable injury. After pairing in spring, the females oviposit on the young bean pods, into which the larvae penetrate to bore into the seeds, where they develop up to the adult stage, some of the adults emerging in autumn and some in spring.

In 1934 and 1935, seeds from the infested crop of several varieties of horse bean from adjoining experimental plots in Saxony were examined. In 1934, the percentage of infestation was 47·8 in a variety that bloomed on 22nd May and only 34·1–35·8 in three varieties that bloomed 1–3 days later, with corresponding losses in weight of crop of 11·5 and 6·7–9·3 per cent. In 1935, in 3 varieties examined, the infestation ranged from 19 to 35·5 per cent. with weight losses of 7·3 and 15·5 per cent. and flowering on 11th June and 5th June respectively, the wider interval in dates of blossoming corresponding to a greater difference in infestation. It must, however, be remembered that with such small adjoining plots and such an actively migrant insect, these findings merely indicate differences in attack and not varietal susceptibility, for not only the development of the plant but also that of the pest is subject to ecological factors. The female, after fertilisation in spring, requires for egg-maturation a time that varies with temperature. If maturity is reached before flowering, the females migrate to the earliest variety, subsequently passing to others when they flower. If egg-maturation is late in relation to flowering, the infestation of the different varieties has a different relation to the date of blossoming.

Germination of the seeds was scarcely affected by infestation. The larvae usually fed on the cotyledons and did not attack the embryo, injury to which occurred in only 0·5 per cent. of the seeds in 1935. It was greater in seeds held over from the 1934 crop, so that it is necessary to reject the use of the previous year's seed, which is often recommended as a measure against this pest.

Weitere Kartoffelkäferfunde. [Further Discoveries of the Potato Beetle.]—*NachrBl. dtsch. PflSchDienst.* **16** no. 8 p. 78. Berlin, August 1936.

Between 30th June and 18th July 1936, the potato beetle [*Leptinotarsa decemlineata*, Say] was found in 13 additional places [*cf. R.A.E.*, A **24** 640] in the Saar and neighbouring parts of Germany at distances ranging from 3 to 15 miles from the French and Luxemburg frontiers.

Auftreten der Blutlauszehrwespe *Aphelinus mali* **Hald. in Polen.** [The Occurrence of *A. mali* in Poland.].—*Nachr.Bl. dtsch. PflSchDienst.* **16** no. 8 p. 79. Berlin, August 1936.

It is reported that the woolly aphis [*Eriosoma lanigerum*, Hsm.] has been found to be parasitised by *Aphelinus mali*, Hald., in various parts of Poland [*cf. R.A.E.*, A **24** 131]. The parasite has established itself without having been artificially introduced and has withstood the severe Polish winter.

Schwartz (G.). **Haarmücke als Roggenschädling.** [A Bibionid as a Pest of Rye.]—*NachrBl. dtsch. PflSchDienst.* **16** no. 8 p. 79. Berlin, August 1936.

Bibionid larvae did considerable injury to rye in Schleswig-Holstein in the late autumn of 1935; the species concerned was not *Bibio hortulanus*, L. [*cf. R.A.E.*, A **24** 268].

Franz (E.). **Ein nord-amerikanischer Käfer in einer Frankfurter Anrichte.** [A North American Beetle in a Dresser in Frankfurt.]—*Natur u. Volk* **66** no. 7 p. 370, 1 fig. Frankfurt a.M., July 1936.

An adult of *Buprestis aurulenta*, L., known as a pest of pine in North America, emerged in 1935 at Frankfurt a.M. from a dresser made 13 years previously, partly of wood of American origin.

Emmel (L.). **Aus dem Leben des Lilienhähnchens** (*Crioceris lilii*). [Biological Notes on *Lilioceris lilii*.]—*Natur u. Volk* **66** no. 8 pp. 424–428, 8 figs. Frankfurt a.M., August 1936.

Notes are given on the stridulating organ and on pairing of adults of *Lilioceris* (*Crioceris*) *lilii*, Scop., which occur in spring and summer on lilies in Germany. The female lays eggs in rows on the large leaves. The larvae cover themselves with their own excreta, apparently for concealment. Pupation occurs in the soil, and the winter is passed in the pupal stage.

Mathers (W. G.). **Time of Felling in relation to Injury from Ambrosia Beetles or Pin Worms.**—*Brit. Columbia Lumberman* **19** no. 8 p. 14. August 1935. (Abstr. in *Emp. For. J.* **14** no. 2 p. 318. London, 1935.) [Recd. July 1936.]

From a summary of information on the flight periods of *Gnathotrichus sulcatus*, Lec., *Xyloterus* (*Trypodendron*) *cavifrons*, Mannh., and *Platypus wilsoni*, Swaine, which infest western hemlock (*Tsuga heterophylla*) in Canada, the author concludes that the time of felling has very little effect on the immunity of logs from attack by these borers, but that in the coast region of British Columbia logging can be carried on in October–March without risk of infestation, since during this period the adults are not in flight. Extraction of all logs not later than the first week in April is, however, essential.

Craighead (F. C.). **Insects that attack Southern Pines.**—*Misc. Publ. U.S. Dep. Agric.* no. 209 pp. 132–141, 8 figs., 21 refs. Washington, D.C., January 1935. [Recd. July 1936.]

Brief notes are given from the literature on the insect pests of pines, chiefly *Pinus palustris* and *P. caribaea*, in the south-eastern United States, where these trees are of major importance for the production of turpentine and resin. They include *Buprestis apricans*, Hbst. [*cf. R.A.E.*, A **21** 95] ; *Dendroctonus frontalis*, Zimm. [*cf.* **13** 510 ; **18** 111 ; **20** 171], which is the most injurious pest ; *Ips grandicollis*, Eichh., *I. calligraphus*, Germ., and *I. avulsus*, Eichh. [*cf.* **20** 171], which may contribute to the death of trees during periods of severe drought ; and *Rhyacionia frustrana*, Comst., which is mainly destructive to seedlings and saplings. *Dendroctonus terebrans*, Ol., which breeds in stumps and felled logs, attacks the bases of pines that have been otherwise weakened, but seldom kills the trees. The larvae of *Monochamus titillator*, F., hatch from eggs laid in the bark of recently felled logs and bore through the sapwood, often destroying it completely. Infestation can be prevented by prompt removal of the bark. Pinhole borers, which bore in the sapwood and heartwood of weakened trees and green logs, may reduce the value of the timber by 50 per cent. in a few weeks.

Protection is given by rapid drying. Ants, including *Cremastogaster lineolata*, Say, and *Tapinoma* sp., have been observed attacking seedlings that had just germinated.

Griswold (G. H.) & Crowell (M. F.). **The Effect of Humidity on the Development of the Webbing Clothes Moth (*Tineola biselliella* Hum.).**—*Ecology* **17** no. 2 pp. 241–250, 2 graphs, 1 fig., 10 refs. Brooklyn, N.Y., April 1936.

The results are given of experiments in the winters of 1933–34 and 1934–35 to determine whether the high humidity of the spring and summer months in the United States may be correlated with the presence of larger numbers of the clothes moth, *Tineola biselliella*, Humm., at these seasons. The following is taken from the authors' summary. Experiments were conducted at a constant temperature of 25°C. [77°F.] ±1°C. [1·8°F.] and at relative humidities of 20, 32, 43, 75 and 93 per cent. The most favourable humidity for the development of the insects proved to be 75 per cent., at which the life-cycles for both males and females were shortest, the highest percentage of larvae completed their development and emerged as adults, and both male and female adults lived longest. The results obtained suggest that the percentage of relative humidity in dwellings may have some effect on the number of clothes moths present, the dry atmosphere of the ordinary house in winter retarding development and the damper conditions of spring and summer accelerating it.

Britton (W. E.). **Connecticut State Entomologist, Thirty-fifth Report 1935.**—*Bull. Conn. agric. Exp. Sta.* no. 383 pp. 245–366 & xi–xvi, 29 figs., many refs. New Haven, Conn., April 1936.

Britton gives an annotated list (pp. 252–267) of insect pests occurring in Connecticut during 1935. *Porthetria dispar*, L., partly or completely defoliated many acres of woodland in the north-east of the State in spite of extended control work, an account of which is given by Britton, J. T. Ashworth and O. B. Cooke (pp. 285–291). In the course of the season 296,956 acres of woodland were surveyed, 369 infestations were found, 345,935 egg-clusters were treated with creosote, and 721,799 larvae and pupae were killed. At one farm where maize had been grown between rows of young apple trees, the apples were infested by *Pyrausta nubilalis*, Hb., and second generation larvae injured dahlias in many localities. Britton, M. P. Zappe and N. Turner (pp. 301–303) report on the application of control measures against this moth. Preliminary experiments indicated that infestation is affected by both date of planting and date of maturity of the maize. All maize maturing in the last half of July (regardless of planting date) was heavily infested with first generation larvae and that maturing in late August was infested with second generation larvae, while maize planted when adults of the overwintered generation were in flight was moderately damaged, and late plants less injured than early ones. Two generations of *Heliothis armigera*, Hb. (*obsoleta*, F.) occurred on maize in 1935. The larvae were prevalent from late July to mid-August, and during September, respectively, and the percentages of infestation by the two broods were 3·2 and 31·1. Of the maize maturing late in September, 47·8 per cent. was infested by *P. nubilalis*, 23·5 per cent. by *H. armigera*, and 37·5 per cent. was uninfested. J. P. Johnson reports (pp. 304–305) that the Japanese beetle, *Popillia japonica*, Newm., has become

more abundant in old centres of infestation on the coast and in the centre of the State. Traps were set from July to early September, but beetles were only taken in one town in the north-west. They were found earlier and for a longer period than in 1934 [*R.A.E.*, A **23** 550], from 29th June to 12th October. One new infestation was reported.

An account (pp. 305–308) is given by Zappe and E. M. Stoddard of spraying tests on apples. Sprays containing 6 lb. dry lime-sulphur, 5 lb. flotation sulphur or 5 lb. magnetic sulphur, each with 3 lb. lead arsenate in 100 U.S. gals. water, were applied six times between 2nd May and 16th July to small plots containing McIntosh and Fall Pippin trees. On McIntosh apples there was a difference of about 3 per cent. between the best and the worst treatments, magnetic sulphur giving 97·48 and dry lime-sulphur 94·82 per cent. sound fruit, while only 7·43 per cent. of the unsprayed fruit was sound, 31·76 per cent. being attacked by plum curculio [*Conotrachelus nenuphar*, Hbst.], 1·37 per cent. by codling moth [*Cydia pomonella*, L.] and 60·00 per cent. by other chewing insects. The Fall Pippins treated with the flotation sulphur spray produced 90·97 per cent. uninjured fruit and the control trees 12·79 per cent. uninjured, 46·08 damaged by *Conotrachelus*, 0·36 by *Cydia* and 21·94 by other chewing insects. One large plot was sprayed 5 times, ending on 16th July, with 3 lb. lead arsenate, 10 lb. hydrated lime, and 1 U.S. qt. fish oil in 100 U.S. gals. water, and another with the same mixture substituting raw linseed oil for fish oil. The sprays were about equally effective, 7·94 and 5·82 per cent. of the fruit, respectively, being damaged by *Conotrachelus* and 1·72 and 1·75 per cent. by other chewing insects, as compared with 56·93 and 34·73 per cent. on unsprayed trees. Sprays containing sulphur are preferable to those containing fish or linseed oil for apples susceptible to scab.

G. H. Plumb gives an account (pp. 308–312) of the European spruce sawfly, *Diprion polytomus*, Htg., which is reported for the first time from Connecticut. It probably entered from the infested areas in southern Canada [*cf.* **23** 236]. In Connecticut the chief food-plant is Norway spruce [*Picea abies*], and the defoliation of the trees in the north-west shows that the sawfly may have been present for 4–5 years. Eggs are laid on the needles. One female killed about 24 hours after emergence contained 46 mature and 19 immature eggs. This sawfly is parthenogenetic, and no males have been taken in Connecticut. In a laboratory at 76°F. and 63 per cent. humidity, the eggs hatched in 5–6 days, and the five larval instars lasted 3–6, 2–6, 3–6, 5–7 and 5–9 days. Cocoons are formed 2–3 ins. below the surface of the litter beneath the trees, and the period in the cocoon generally lasts for 10–12 days, although possibly for months or years. Two generations and possibly part of a third occur in Connecticut. Many of the cocoons are destroyed by rodents, and *Podisus maculiventris*, Say, has been observed preying on the larvae. In one stand of Norway spruce, infestation appeared to be heavier on trees about 15 ft. high than on those 4–6 ft. high. *Matsucoccus matsumurae*, Kuw., which infests pine in the United States and Japan [**9** 201], is also recorded by Plumb (p. 313) for the first time in Connecticut, denuding and killing many twigs.

Work on orchard pests and their control is the subject of a series of reports by P. Garman (pp. 313–326). In one nursery in August larvae of *Lachnosterna* (*Phyllophaga*) *fusca*, Fröl., damaged about 10 per cent. of seedling apple and pear trees growing on land previously under grass.

Treatments with carbon bisulphide were expensive and not sufficiently effective to be practical. In experiments on the breeding and control of the apple maggot (*Rhagoletis pomonella*, Walsh) pairing and oviposition took place normally at 75–78°F. and 60–65 per cent. humidity. The flies lived for a maximum of 103 days, and an average of 41 days, in the late summer and early autumn [*cf.* **23** 553]. Maximum oviposition was reached 2½–4 weeks after emergence. Tests on materials for use as repellents showed that talc, lime, and sulphur, when applied as dusts, repel the fly and prevent oviposition. Other chemicals were less effective, and iso-amyl phthalate increased oviposition. Thus lime in itself probably has considerable value in sprays used to control this Trypetid. In spraying experiments with insecticides that showed promise in the laboratory, lead arsenate gave good control; it was rather more effective than cryolite and much more effective than derris, though the latter caused a marked reduction in infestation. In investigations on the cause of arsenical scorching on peach trees, 13 commercial brands of lead arsenate were analysed and tested on beans and peach. The amount of scorching seemed more closely associated with the total water-soluble arsenic than with arsenic trioxide. Owing to dry weather in August, apples showed more spray residue than usual. In continuation of tests to find substitutes for lead arsenate [*cf.* **23** 551], 65·4 per cent. of fruit was free from injury by insects after spraying with natural cryolite and flotation sulphur, and 91·5 per cent. after lead arsenate and flotation sulphur. A spray containing ground derris with skim milk and bentonite gave 32 per cent. sound fruit and the control trees 24·4 per cent. Parasites of the oriental fruit moth [*Cydia molesta*, Busck] reared and liberated during 1935 included over 11 million individuals of *Trichogramma minutum*, Riley, and *T. pretiosum*, Riley, 7,850 of *Perisierola angulata*, Mues., 6,462 of *Macrocentrus ancylivorus*, Rohw., 5,199 of *Microdus* (*Bassus*) *diversus*, Mues., and 1,200 of *Angitia* (*Dioctes*) *molestae*, Uch., the last two having been reared for this purpose for the first time. Liberations were made in peach orchards where twigs had been injured by the first two generations. *Macrocentrus* was recovered from some orchards, but parasitism by this species appears to be decreasing, probably because of the scarcity of the moth.

B. H. Walden states (pp. 328–329) that since 1929 *Blissus hirtus*, Montd., which is regarded as an eastern variety of *B. leucopterus*, Say, has caused severe damage to lawns, chiefly those containing a high proportion of bent grass. The adults hibernate under leaves and rubbish, and emerge in spring when the temperature reaches about 70°F. for some hours on consecutive days. The eggs are laid on the stems and roots of the grass near or just below the ground. Two overlapping generations occur during the year; adults have been taken from 1st April to October, and nymphs from 17th June to October. A spray of 1 U.S. qt. nicotine sulphate and 4 lb. soap in 100 U.S. gals. water, applied at the rate of 25–30 gals. to 100 sq. ft., gave satisfactory control. Zappe (pp. 329–330) describes further infestations of English ivy, iris, rose, chrysanthemum, clover, etc., by *Calomycterus setarius*, Roel. [*cf.* **21** 511, etc.]. This weevil has probably spread through transport of plants or building materials. Eggs and larvae have not been found. Plumb gives short descriptions (pp. 331–333) of the larva, pupa and adult of *Tetralopha robustella*, Zell. The globular masses of excrement surrounding the silken tubes in which the larvae live appear on pine trees about mid-September, and the larvae feed on the needles until they mature in mid-October. Pupation takes place in the ground,

and the adults do not emerge till the late summer of the following year. It is not known where the eggs are deposited, but probably on the needles or in the bark.

Observations by R. L. Beard (pp. 333–339) of *Anasa tristis*, DeG., on squash and related cucurbits showed that in 1935 the heaviest oviposition occurred during mid-July ; one female in captivity laid 409 eggs. Of the adult bugs 53·5 per cent. were parasitised by the first generation of *Trichopoda pennipes*, F., in one place and 6·4 per cent. by the second generation in another. The pupal stage of the first generation of this Tachinid lasts about a month. Nymphs of the fourth and fifth instars as well as the adult bugs are parasitised. Further field tests against *A. tristis* with a spray containing a kerosene extract of pyrethrum emulsified with soap [**23** 551] showed that the total yield from the sprayed plot was only 4·09 per cent. higher than from the check plot, though for the period during August when the nymphs in later instars were abundant the difference was 25·3 per cent. Turner and Zappe contribute a note (p. 340) on termite damage [*cf.* **24** 387] and a record of infested houses. By experimental infestation of sprigs of Norway spruce by *Chermes* (*Adelges*) *abietis*, L., R. B. Friend (pp. 341–344) showed that the effect of the fundatrix occurs when growth begins in the spring, and that the gallicolae cannot establish themselves on any needle not previously affected by the fundatrix, though their presence is essential for the formation of a complete gall. A summary is given by J. C. Schread (pp. 344–346) of preliminary investigations of the parasitism of the eggs of *Pyrausta nubilalis* on maize following liberation of *Trichogramma pretiosum*, Riley, at the rate of 10–30 thousand per acre, which gave no significant results. J. F. Townsend describes (pp. 346–350) a basement room for breeding insects, in which temperature and humidity are controlled.

Brief notes (pp. 350–362) are given by several of the above authors on miscellaneous insects that occurred during the year including : *Pompho-poea sayi*, Lec., adults of which attacked apple and wild cherry foliage ; *Corythucha ulmi*, Osb. & Drake, on elm ; *Lyctus* sp. injuring timber in old buildings ; *Anthonomus signatus*, Say, which caused a 20 per cent. loss in one strawberry field, damaging the later buds particularly ; *Agromyza maculosa*, Malloch, which mined the leaves of chrysanthemum in a greenhouse and may be controlled by a spray of nicotine sulphate applied every 10–12 days ; and *Myzocallis ulmifolii*, Monell, on elm. A consignment of *Hippodamia convergens*, Guér., was obtained from California, and about 220,000 were released in May in an apple orchard of 1,000 trees against the rosy aphis [*Anuraphis roseus*, Baker], but none was recovered. Peaches were extensively injured by *Lygus* spp., particularly near oaks and hickories, from which they may have migrated. Infestation of apples by *Tortrix* (*Archips*) *argyrospila*, Wlk., which had been severe in one locality in 1934, was controlled by spraying with 6 per cent. oil emulsified with Bordeaux mixture, followed by lead arsenate. In the laboratory, the same emulsion was not so effective against the eggs as oil emulsified with skim milk powder, diglycol oleate or glyceryl oleate. Some success in the control of black carpenter ants (*Camponotus herculeanus pennsylvanicus*, DeG.), which injure the timbers of buildings by making excavations for their nests, was obtained by the use of a poison bait consisting of a sweetened paste containing 1 per cent. thallium sulphate and also by

fumigation. For this purpose a hole is made in the timber at the top of the excavation and a solution of 1 lb. paradichlorobenzene in ½ U.S. gal. petrol is poured in. The hole is then closed with a wooden plug.

Essig (E. O.) & Michelbacher (A. E.). **Important Tomato Insects of California.**—*Circ. Calif. agric. Ext. Serv.* no. 99, 38 pp., 24 figs., 30 refs. Berkeley, Calif., May 1936.

In the processes of preparing canned tomato products, insects and their cast skins present in the fruit at harvest are divided into microscopic pieces. It has been found, however, that if a small quantity of the tomato product is shaken with petrol and water, the insect parts come to the surface and may be removed and examined with a microscope. As a result of this, a tolerance has been placed in the United States of 15, 25 or 60 insect parts per 200 cc. of tomato product, according to the concentration of the latter. Increased attention is therefore being devoted to tomato pests, and in this report an account is given, mainly from the literature, of the bionomics of some of the more important of them, with special reference to damage and control methods in California. Chief attention is devoted to *Heliothis armigera*, Hb. (*obsoleta*, F.), *Phthorimaea* (*Gnorimoschema*) *lycopersicella*, Busck, and *P. operculella*, Zell., and anatomical parts of the larvae of these moths are figured so that they may be identified in tomato products.

Three generations a year of *H. armigera* occur in California. In warm weather the larvae hatch in 3–4 days and mature in about 2 weeks. They enter the fruit at the calyx by a small hole that is difficult to detect, and one larva may attack several tomatos. They may destroy as much as 50 per cent. of the crop in many localities. During 1935, infestation varied from 3 to 22·17 per cent. in central California, and from 1·5 to 15·7 per cent. in the south of the State. In some fields infestation seemed to decline in the later pickings. Control methods recommended include thorough autumn ploughing to expose the overwintering pupae. If maize is used for a trap crop, it should be planted so that it will be in the tassel or silking stage when the tomatos need protection, and should be harvested before the larvae have matured. Dusts of calcium arsenate (undiluted) or lead arsenate, barium or sodium fluosilicate, or synthetic cryolite, each mixed with about 50 per cent. of a carrier, appear to be of value if applied frequently, but not too near harvest, because of the residue problem.

During 1935, infestation of the plants and fruit of tomato by *Phthorimaea lycopersicella* exceeded 50 per cent. in some fields in southern California, and these had to be abandoned. Infestation is not serious in the centre and north of the State. The larvae prefer to enter the fruit at the calyx end. The dusts used against *H. armigera* are not satisfactory against them. Destruction of the tomato plants as soon as harvest is complete is recommended to prevent the emergence of the later moths. *Phthorimaea operculella* attacks tomatos throughout California, generally the fruit, but sometimes other parts of the plant. In 1935 infestation was very light, being heaviest where tomatos followed potatoes in crop rotation. In one area from 5 to 57 per cent. of the fruits were attacked. Up to 16 larvae may be found in one fruit, but more often 1–3. The life-cycle lasts from 1 month in the summer to 3–4 in the winter, and in storage breeding occurs throughout the year if the temperature is not too low. Clean culture is recommended, and tomatos should not be planted after potatoes. It is possible that

the more exposed fruit is preferred, in which case luxuriant plants should show the lowest relative infestation.

Brief notes are given on a few other pests, including *Protoparce sexta*, Joh., and *P. quinquemaculata*, Haw., which strip the leaves and damage the developing fruit, and against which cryolite dust is very effective; army worms; *Listroderes costirostris*, Schönh.; and the Tenebrionids *Blapstinus* spp. and *Metoponium abnorme*, Lec., which girdle the plants and against which a bait of 25 lb. bran, 1 lb. arsenic trioxide and 2 U.S. quarts molasses is recommended.

MACKIE (D. B.). **Entomological Service.**—*Mon. Bull. Dep. Agric. Calif.* **24** (1935) no. 4 pp. 403–430. Sacramento, Calif., 1936.

Entomological work carried out in California in 1935, including progress in insect eradication programmes [*cf. R.A.E.*, A **24** 458], is reviewed. The area occupied by *Hypera variabilis*, Hbst. (*Phytonomus posticus*, Gyll.) showed only a slight increase over 1934. A general infestation by *Listroderes costirostris*, Schönh. (vegetable weevil) was discovered in two counties, the tendency to grow mustard as a cover crop providing it with a preferred food-plant. *Parlatoria oleae*, Colv., first collected on ripe olives in October 1934, was found to be distributed over about 100 sq. miles, and had probably been present for a considerable time. Examination of plants suggests that the old wood supports the largest percentage of scale, but later in the year foliage, branches and fruit are attacked. *P. oleae* has also been collected from a number of fruit trees and other plants, pear and olive being the most severely infested. A survey of vines in areas where *Phylloxera vitifoliae*, Fitch, was once established gave negative results.

Cotinis texana, Casey (peach beetle) was first reported to the Department of Agriculture in October 1935, but appears to have been present for a number of years. It is single brooded, the adults being active from June till September. Figs on which they were feeding were found in all cases to have been previously pecked by birds. As manure heaps are favoured places of oviposition, the use of organic fertilisers may produce foci of infestation. There was a considerable spread in the distribution of *Forficula auricularia*, L. *Aspidiotus forbesi*, Johns., was found to be confined to the block of pear trees on which it was first observed [**23** 700].

The outbreak of grasshoppers [*cf.* **23** 699] appears to be gradually subsiding, maximum population having been reached in one district in 1935, when *Camnula pellucida*, Scudd., was the most numerous species. Infestation by *Hercothrips fasciatus*, Perg., which caused considerable damage to beans, has been reduced by 85 per cent. in one county by removal of native food-plants, and a certain amount of control was obtained in two cases by the application of a dust of equal parts of cryolite and sulphur. *Taeniothrips inconsequens*, Uzel, which has recently assumed economic significance, caused russeting and scabbing of prunes and pears. An unexpected outbreak of plant bugs of the genera *Acrosternum*, *Chlorochroa* and *Thyanta* occurred, beginning in early spring, when *Acrosternum hilare*, Say, caused serious injury to apricots. Damage was widespread on cotton and *Sorghum* and slighter on barley. Severe injury was caused to vines by two Sphingids [*Pholus achemon*, Drury, and *Celerio lineata*, F.], the first brood of which entirely defoliated some vineyards in certain areas. Damage to *Citrus* was caused by *Lycophotia margaritosa*, Haw.,

Xylomyges curialis, Grote, and *Trachea* (*Parastichtis*) *purpurea*, Heinr. *Cydia* (*Carpocapsa*) *pomonella*, L., which was again numerous, was reported several times as attacking peaches, and infestation by second brood larvae was higher than usual in pears, which were harvested about a month later than in 1934.

CLAUSEN (C. P.). **Insect Parasitism and Biological Control.**—*Ann. ent. Soc. Amer.* **29** no. 2 pp. 201–223, 6 figs., 14 refs. Columbus, Ohio, June 1936.

A general account is given of some practical aspects of biological control, including brief discussions on the differing efficiency of biological or geographical races of the same parasites in controlling pests, the effect of spraying and dusting with insecticides on biological control, and the utilisation of native parasites and predators. The early history and present status of biological control in the United States are outlined, and the world-wide scope of the method and some of the results obtained are reviewed.

DONER (M. H.). **Hymenopterous Parasites of** *Coleophora pruniella* **Cl., and Parasites recorded from other Species of** *Coleophora*.—*Ann. ent. Soc. Amer.* **29** no. 2 pp. 224–244, 30 refs. Columbus, Ohio, June 1936.

An account is given of investigations in Wisconsin on the parasites of *Coleophora pruniella*, Clem., a pest of apple and cherry, including observations on their oviposition habits, relative abundance and economic value. A list, arranged by hosts, of the parasites of the various species of *Coleophora* in the United States and Canada, showing the origin of each record, is appended.

The parasites reared from *C. pruniella* in Wisconsin comprised 3 Braconids, 5 Ichneumonids and 24 Chalcidoids. The eggs were attacked only by *Trichogramma minutum*, Riley, the mining larvae of the first instar by *Derostenus* sp., and the young late summer larvae in their small cases by *Derostenus* sp., *Chrysocharis ainsliei*, Cwfd., and *Eurydinota lividicorpus*, Gir., the last two passing the winter on their hosts. The mature larvae in their four-compartment cases were the recipients of the greatest amount of parasitism, notably by *Microbracon pygmaeus*, Prov. [*cf. R.A.E.*, A **22** 691], *Pimpla* (*Ephialtes*) *conquisitor*, Say, *P.* (*Scambus*) *indagatrix*, Cress., *E. lividicorpus*, *Cirrospilus* spp., and *Habrocytus* spp. The only true pupal parasite was *Spilochalcis torvina*, Cress. All of the larval parasites were ectoparasites; the adults escaped from the cases by eating their way to the exterior. In several instances, a single host larva was attacked by two or more species of primary parasites. As many as 10 adults of the same species often emerged from a single host in the case of *E. lividicorpus*, *Cirrospilus flavicinctus*, Riley, and *C. cinctithorax*, Gir. Of the remaining species, only one parasite attacked one host. The hyperparasite, *Hemiteles tenellus*, Say, also acted as a primary parasite, and other species occasionally acted as hyperparasites. Of the parasites examined 75·3 per cent. were *M. pygmaeus* in 1932, and 26·1 per cent. in 1933. The percentage represented by *P. conquisitor* and *P. indagatrix* increased from 2·1 in 1932 to 27·4 in 1933, that by *Habrocytus thyridopterigis*, How., from 3·7 to 13·7 and that by *E. lividicorpus* from 5·9 to

18·5. The percentage of parasitism in the orchards of north-eastern Wisconsin varied greatly ; that of over-wintering larvae never exceeded 23 ; that of mature larvae ranged from 5 in some high infestations to 58·8 in light and moderate infestations.

FLANDERS (S. E.). **A Biological Phenomenon affecting the Establishment of Aphelinidae as Parasites.**—*Ann. ent. Soc. Amer.* **29** no. 2 pp. 251–255, 6 refs. Columbus, Ohio, June 1936.

The author reviews observations by various workers that have a bearing on his own findings regarding the differential development of the sexes of Aphelinids [*cf. R.A.E., A* **24** 546, etc.]. In 1913, P. H. Timberlake found that *Coccophagus lycimnia*, Wlk. (*lecanii*, Fitch) was occasionally a hyperparasite as well as a parasite of *Coccus hesperidum*, L. [**1** 309] ; in the second case the larvae were always endoparasitic, but in the first case the eggs were laid on full-grown larvae or pupae of a primary parasite and the larvae invariably developed, ectoparasitically, into males. These males did not appear to be essential to the species, however, as females were regularly produced by parthenogenetic reproduction. In a study of the parasites of *Aspidiotus destructor*, Sign. [**23** 279], T. H. C. Taylor found that *Casca parvipennis*, Gah., and *Physcus varicornis*, How., developed into males when feeding on a primary parasite. *P. varicornis* appeared deliberately to attack scales containing larvae and pupae of its own species, and the male larvae were endoparasitic during the greater part of their feeding period, but matured as ectoparasites. Male adults of the genus *Prospaltella*, which is normally parasitic on Diaspine Coccids, were reared from eggs of the codling moth [*Cydia pomonella*, L.] by the author [**12** 585] and from those of other moths by E. G. Davis [**22** 320] ; they had possibly been attacking larvae of *Trichogramma*, in which case over 70 per cent. of the codling moth eggs were hyperparasitised. While studying the biology of *Coccophagus* spp., S. M. Cendaña observed in 1934 that eggs of unpaired females of *C. gurneyi*, Comp., and *C. trifasciatus*, Comp., did not hatch although the embryo developed and lived in the body fluids of the host for periods up to 85 days. He believed this " inhibited hatching " to be abnormal.

Notes are given on the oviposition habits of *C. scutellaris*, Dalm., *C. lycimnia* and *C. gurneyi* as observed by the author [*cf.* **24** 547]. The progeny of the fertilised females of *C. modestus* var. *capensis*, Comp., develop endoparasitically within the body cavity of Lecaniine scales, but male eggs are deposited by unpaired females in the pupae of the primary parasite. The oviposition habits of *C. trifasciatus*, Comp., like those of *C. gurneyi* [*loc. cit.*] are not changed by fertilisation. The male larva of *C. trifasciatus* is ectoparasitic in all instars, but rarely parasitises its own species since the female does not entirely consume the body fluids of the host, which inhibit hatching of the male egg. It is thus impossible to rear *C. trifasciatus* in a pure population. The author points out that these phenomena will influence the establishment of introduced species, as in a pure population of an Aphelinid reproduction is frequently dependent on the destruction of some of the female larvae by male larvae. The first liberation of a species such as *C. lycimnia* or *C. modestus* var. *capensis* should be followed by a second when the progeny of the first are susceptible to parasitism by the offspring of unpaired females.

Menusan, jr. (H.). **The Influence of constant Temperatures and Humidities on the Rate of Growth and relative Size of the Bean Weevil,** *Bruchus obtectus* **Say.**—*Ann. ent. Soc. Amer.* **29** no. 2 pp. 279–288, 5 figs., 13 refs. Columbus, Ohio, June 1936.

In experiments on the effect of different environments on the rate of growth of larvae and the resultant size of adults, *Bruchus obtectus*, Say, *Tribolium confusum*, Duval, and *Tenebrio molitor*, L., were reared at constant environments on an excess of suitable food. In the case of *Bruchus* and *Tribolium*, the weights of the adults obtained were determined; *Tenebrio* was used to ascertain the rate of larval growth. Both temperature and humidity influenced the adult weight and larval growth, and therefore the rate of insect metabolism. Increasing the relative humidity of the air from 10 to 90 per cent. at all the temperatures tried (17–31°C. [62·6–87·8°F.]) decreased the time required for development and increased the size of the resultant adults. When the moisture content of the food and the relative humidity of the environment were constant, the adult weight increased as the temperature decreased. The differences in weight of adults or in growth of larvae were not due to differences in water content. The water content of the adult Bruchids remained practically constant regardless of the humidity or temperature at which they were reared. Similarly, with *Tenebrio* the percentage of water was inversely proportional to the size of the larvae and, within the range of the experiments, independent of temperature or humidity.

Sanidad Vegetal. Leyes, decretos, resoluciones y reglamentos sobre la materia. [Plant Health. Laws, Decrees, Resolutions and Regulations.]—vii+127 pp., illust. Lima, Minist. Fom., Direcc. Agric., May 1936.

A brief account of the organisation of plant protection work in Peru is followed by the texts of the regulations in force regarding the import, export and cultivation of plants and the control of pests.

Blanchard (E. E.). **Dos tisanópteros nuevos para la República Argentina y algunos apuntes sobre especies vecinas.** [Two Thysanoptera new for Argentina and some Notes on allied Species.]—*Physis* **12** no. 42 pp. 103–109, 4 figs., 8 refs. Buenos Aires, 30th April 1936. [Recd. August 1936.]

Taeniothrips simplex, Morison (*gladioli*, Moult. & Stnw.) on *Gladiolus*, and *Hercothrips femoralis*, Reut., on *Amaryllis*, are recorded for the first time from Argentina. *T. inconsequens*, Uzel, was recorded in pear blossom in 1921, but has not become a pest. *Hercothrips fasciatus*, Perg., which was found on *Citrus* in 1930, has recently caused considerable injury to cotton. *Heliothrips haemorrhoidalis*, Bch., was taken on *Euonymus* in 1915, and has since been observed on various hot-house plants. A key to these 5 species is given.

Lizer y Trelles (C. A.). **Algunas cochinillas nuevas para la fauna de la República Argentina.** [Some Coccids new to the Fauna of Argentina.]—*Physis* **12** no. 42 pp. 113–116. Buenos Aires, 30th April 1936. [Recd. August 1936.]

The 12 Coccids recorded include *Aspidiotus ostreaeformis*, Curt., on fig and elm, and *Chrysomphalus scutiformis*, Ckll., *Pinnaspis*

(*Hemichionaspis*) *aspidistrae*, Sign., *P.* (*H.*) *minor*, Mask., and *Orthezia praelonga*, Dougl., on *Citrus*. *C. scutiformis* was also taken on olive and other plants.

JEPSON (W. F.). **A Summary of the Results of the *Phytalus* Investigations 1933–36 with Recommendations as to further Lines of Work.**—19 pp. Port Louis, 1936.

Some of the information in this review of investigations connected with the control of *Lachnosterna* (*Phytalus*) *smithi*, Arr., on sugar-cane in Mauritius has already been noticed [*cf. R.A.E.*, A **22** 620; **24** 436, etc.]. A study of the position in 1934 shows that hand collection does not account for a large enough proportion of the beetle population for control, as half of those collected are males and many of the females have already deposited their eggs. In preliminary experiments in mechanical control it was found that most of the larvae work within 8 inches of the centre of the stool where they could not be killed by forking. Covering the free soil surface with a layer of trash about 2 ft. thick does prevent oviposition, and decreased infestation results.

The comparative failure of the introduced Scoliid, *Campsomeris coelebs*, Sich. (*thoracica*, auct.), to control *L. smithi* in Mauritius is partly due to the scarcity of host larvae in summer, when the parasite is most active, and to the absence in cane fields of a herbaceous weed on the flowers of which the adults feed. With a view to discovering a more efficient species, the importation of as many species of *Campsomeris*, *Tiphia* and *Elis* as possible is recommended. A programme for Scoliid importation was carried out from June to September 1934 by P. Regnard, who made mass collections in Madagascar and sent 39,000 female Scoliids to Mauritius with a survival rate of 76 per cent. A total of 29,000, the great majority of which were *C. pilosella*, Sauss., were liberated throughout the Island. The other species liberated were 250 *C. pfeifferi*, Sauss., and *C. pocillator*, Bradley, 118 *Elis* (*Mesa*) *nodosa*, Guer., and an unknown number of *C. minutalis*, Bradley. Later in 1934 more than 8,000 females of *Campsomeris erythrogaster*, Dalm., were shipped to Mauritius with a mortality of 35 per cent., and 4,700 were liberated.

An account is given of the work of collecting further parasites in Java, the Philippines and Malaya in 1935–36. As a result of the shipment of over 12,000 Scoliids from West Java, sufficient material has been released in Mauritius of *Campsomeris javana*, Lep., *C. annulata*, F., *C. lindeni*, Lep., *C. quadrifasciata*, F., and *C. phalerata*, Sauss., and the first two have already given evidence of having gone through several generations on *L. smithi*. *Prosena siberita*, F., was discovered in large numbers in West Java, where it was found to be parasitic upon *Apogonia destructor*, Bos, *Serica* spp. and *Adoretus compressus*, Web., and occasionally on larger grubs of *Anomala* spp. Details are given of attempts to ship this Tachinid to Mauritius with a view to establishing it upon *Adoretus versutus*, Har., in the hope that in seasons of abundance the second stage larvae of *L. smithi* would also be attacked. Over 8,000 Lamellicorn larvae, of which 20–30 per cent. were thought to be parasitised, were imported, but less than 100 Tachinids were obtained from them for release.

In Negros, Philippine Islands, control of *Leucopholis irrorata*, Chevr., on sugar-cane appears to be largely due to the occurrence in conjunction of *Campsomeris quadrifasciata* var. *negrosicola*, Betr., and

intensive planting of *Stachytarpheta jamaicensis*, on the flowers of which the adults of the parasite feed. Out of a shipment of 10,000 females of this Scoliid only 800 arrived in Mauritius. Similarly out of a shipment of 8,700 of *C. marginella modesta*, Sm. (*Scolia manilae*, Ashm.), only 40 could be released. A shipment of 1,000 females of *Campsomeris prismatica*, Sm., which was found to be abundant on white grubs at altitudes of 4,000–5,000 ft. in Malaya, was dispatched to Mauritius, where 424 were released in the higher, wetter parts of the Island. On the island of Banka *Lachnosterna* (*Holotrichia*) *bidentata*, Burm., was heavily parasitised by *Urodexia uramyoides*, Towns., which has a pupal stage of 15 days or more. Out of a total of 300 puparia of *U. uramyoides* shipped, 150 flies were obtained for liberation in Mauritius, but none from puparia of another Tachinid, which has a shorter pupal stage, or from a later consignment of *U. uramyoides*.

In East Java, large numbers of Scoliids were found parasitising white grubs at the foot of the Tengger Mountains. The species concerned were *Campsomeris leefmansi*, Betr., *C. quadrifasciata* var. *fimbriata*, Burm., *C. quadriguttulata*, Burm., with 8 remarkable vareties, and *C. annulata*. A total of 50 cases containing 32,000 of these wasps was despatched and 3,700 females were finally released in Mauritius.

During the course of the investigation 42 species and varieties of Scoliids have been examined, of which 18 have been imported and released in Mauritius in numbers sufficient for colonisation. *C. pilosella* is now approaching *C. coelebs* in abundance, and *C. annulata*, *C. erythrogaster*, *C. javana* and *C. phalerata* have been recovered in several localities. Recommendations laid down for future procedure are summarised to constitute a permanent policy for continuous parasite work.

Mahdihassan (S.). **The Range of Host-selection and the specific Differentiation of Lac and other Parasites.**—*Arch. Naturgesch.* (N.F.) **5** no. 1 pp. 1–22, 26 refs. Leipzig, 20th April 1936.

This is an account of work on lac insects and other Coccids carried out by the author in 1916–25 in Bangalore, from which the following conclusions are drawn : Of two related Coccids the one presenting a sex ratio more favourable to the male is phylogenetically the older. When two indigenous insects differ in size, the smaller is the better breeder and is probably the more recent. Of two allied species the one with a restricted range of food-plant selection is the more recent and the more dominant. The question of deciding if two insects are species or varieties is answered by finding their respective range of food-plants. When these differ widely, the insects are different species. When two allied and indigenous insects are found on a common food-plant, each would have also a number of food-plants not common to both. If an insect is found on a tree foreign as a food-plant, it is not the insect that has adapted itself, but a chain of factors has prepared the plant for the reception of the insect, which must find its food ready or die.

Isaac (P. V.). **Report of the Imperial Entomologist.**—*Sci. Rep. Inst. agric. Res. Pusa 1933–34* pp. 168–174. Delhi, 1936.

Insect pests recorded at Pusa in 1933–34 and not mentioned in the two previous reports [*R.A.E.*, A **21** 575 ; **23** 55] include : *Prodenia*

litura, F., on early cauliflowers ; *Dysdercus cingulatus*, F., and *Oxycarenus laetus*, Kby., on *Hibiscus esculentus* ; *P. litura*, *Heliothis armigera*, Hb. (*obsoleta*, F.), and *Cyrtopeltis tenuis*, Reut. (*Gallobelicus crassicornis*, Dist.), on tobacco seedlings ; *Maruca testulalis*, Geyer, and *Lamprosema indicata*, F., on pods of *Phaseolus radiatus* and the former also on velvet beans [*Stizolobium*] ; *Chilo oryzae*, Fletcher, and *Nephotettix bipunctatus*, F., on rice ; *Diacrisia obliqua*, Wlk., on potato and *Sesamum indicum* ; and *Ergolis merione*, Cram., on castor [*Ricinus communis*]. *Agrotis ypsilon*, Hfn., damaged tobacco, crucifers, peas and linseed. Hand-picking, trenching and poisoned baits were used in control, and the affected area was flooded, bringing the larvae to the surface, where they were destroyed by birds. The stems of many pea plants in experimental plots were infested by an Agromyzid, but light spraying with naphthalene emulsion restricted oviposition.

The larvae of *Scirpophaga nivella*, F., hibernated in sugar-cane until the third week in February and pupation began in the fourth, the first moth appearing on 28th February. The number of egg-masses laid on sugar-cane in an experimental plot of 2·5 acres was 497 in March, 205 in April, and 575 in May, after which it decreased. The percentages of canes infested by various pests during March–May were 11·55–35·37 by *S. nivella*, 3·2–11·55 by *Emmalocera depressella*, Swinh., 1·48–7·82 by termites, and 2·33–8·01 by *Chilo zonellus*, Swinh., *Argyria sticticraspis*, Hmps., and *Diatraea venosata*, Wlk., together, while 21·10–45·41 per cent. were uninfested. Adults of *Pyrilla* spp., were ovipositing freely on sugar-cane in June. Parasitism of the eggs started in August, and reached a maximum of 94·9 per cent. in late September. From October the eggs were mostly laid on the sheathing leaves, and by the end of the month nymphs were parasitised by *Dryinus pyrillae*, Kieff., and *Chlorodryinus pallidus*, Perkins.

Guava fruits were attacked by *Dichochrocis punctiferalis*, Gn., and *Virachola isocrates*, F., the new growth of mango trees by *Amblyrrhinus poricollis*, Boh., banana fruits by the Eumolpid, *Nodostoma subcostatum*, Jac., peach by *Myzus persicae*, Sulz., and *Citrus* by *Papilio demoleus*, L.

Orchard pests observed in Baluchistan were *Cydia* (*Carpocapsa*) *pomonella*, L., on apple and pear ; *Tortrix* (*Cacoecia*) *pomivora*, Meyr., on apple ; larvae of the Cerambycid, *Aeolesthes sarta*, Solsky, boring in apple and cherry trees ; and *Lachnus persicae*, Cholod., which did considerable damage to peach.

Coolhaas (C.). **Jaarverslag** [Annual Report of the Vorstenland Tobacco Experiment Station, Java] **1 Mei 1934–30 April 1935.**— *Meded. Proefst. vorstenl. Tabak* no. 82, 99 pp., 1 pl., 1 graph. Klaten (Java), 1936.

In his report on the phytopathological division (pp. 27–35), T. H. Thung states that the thrips attacking tobacco in the Vorstenland district [*R.A.E.*, A **22** 168] has been identified as *Isoneurothrips parvispinus*, Karny. Experiments with sprays, dusts and fumigants failed to indicate a completely satisfactory method of control. It is suggested that the seedlings in the beds be sprayed with derris and that 3 days before the seedlings are planted out the beds be put under water to kill the prepupae and pupae in the soil. Finally the lifted seedlings should be dipped in derris suspension immediately before they are planted out. The thrips also occurs on cucumber, and it is necessary to ascertain if other plants are sources of infestation.

Li (Feng-swen). **Pink Bollworm Problem.**—*Ent. & Phytopath.* **4** no. 16–17 pp. 322–334. Hangchow, 11th June 1936.

The bulk of this paper comprises a discussion from the literature of the history, distribution, food-plants and natural enemies of *Platyedra gossypiella*, Saund., and of measures for its control. Lists are given of its food-plants and natural enemies showing the countries in which they have been reported. Notes on some observations made by the author in China are included [*cf. R.A.E.*, A **21** 683]. In 1930 he found that infestation amounted to 15 per cent. of the cotton bolls and that an infested boll contained 1–10 larvae. The length, weight and strength of the fibre were affected by infestation. The only other food-plant of *P. gossypiella* in China appears to be *Hibiscus syriacus*. The parasites recorded from it there are *Microbracon isomera*, Cushm., *M. nigrorufum*, Cushm., *M. onukii*, Watanabe, *Elasmus philippinensis*, Ashm., *Brachymeria euploeae*, Westw., *B. obscurata*, Wlk., *Dibrachys cavus*, Wlk., *Eurytoma* sp., *Pimpla* sp., *Pristomerus* sp. and *P. vulnerator*, Panz.; in 1931, 45 per cent. of the resting-cycle larvae were parasitised by *Microbracon* sp.

Nawa (U.). **Biology and Control Methods of *Adoxophyes privatana* Wlk.** [*In Japanese.*]—*Nawa ent. Lab. Bull.* no. 3, 33 pp., 5 pls. Gifu, Japan, December 1935. [Recd. August 1936.]

Adoxophyes privatana, Wlk., is widely distributed on tea in Japan, the Loochoo Islands and Formosa. In the centre of Japan, it has 4 or 5 generations annually, the moths occurring as early as the end of April and as late as October. The female lays an average of 130 eggs in 3·2 masses on the lower surface of the older leaves. The larvae hatch in 7–13 days and feed on the leaves of the tea for about 3 weeks, having five instars; those of the last generation hibernate in the third or fourth instar.

The eggs of this Tortricid are parasitised by *Trichogramma* sp., the larvae by *Apanteles* sp. and *Chelonus* sp. and the pupae by *Brachymeria* sp. *Polistes* spp., *Rhynchium japonicum*, Dalla Torre, *Eumenes* spp., and a Carabid are predacious on the larvae, and dragonflies on the adults. The eggs can be destroyed by spraying with nicotine sulphate or derris and soap, the former being particularly effective against the older eggs just before they hatch, and the larvae by nicotine sulphate or pyrethrum and soap solution.

Hukkinen (Y.). **Die "Weizenwanze" tritt auch in Finnland drohend auf.** [The "Wheat Bug" is a Menance in Finland also.]—*Suom. Hyönteistiet. Aikakausk.* **1** no. 4 pp. 146–147, 2 figs. Helsingfors, 1935. [Recd. August 1936.]

Several instances of injury to the grains of summer wheat by *Dolycoris baccarum*, L., were observed in Finland in 1935.

Forsslund (K. H.). **Nordliga gransågstekeln (*Lygaeonematus subarcticus* Forssl.) en nyupptäckt skadeinsekt i Lappland.** [*L. subarcticus*, a new Pest in Lapland.]—*Medd. Skogsförsöksanst.* **29** no. 2 pp. 171–186, 5 figs., 20 refs. Stockholm, 1936.

Although it has not been possible to obtain exact details of the life-history of *Lygaeonematus subarcticus*, Forssl., which has recently

caused injury to spruce in Swedish Lapland [*cf. R.A.E.*, A **24** 346, 347], it is concluded from the fact that the eggs were seen on 2nd July and larvae of various sizes a fortnight later that the adults are in flight about the end of June. At the end of July, the larvae migrate to the ground, where they spin cocoons in straw, moss, or the upper layer of soil. Of the other sawflies attacking spruce in Sweden, *L. abietinus*, Christ, is recorded only from the southern provinces, but *L. saxeseni*, Htg., and *L. compressus*, Htg., occur throughout the greater part of the country. The larvae of *L. subarcticus*, like those of the other three species, are found only among the needles of the May shoots, which are partly consumed, the remaining needles withering and becoming discoloured. Infestation is usually confined to the tops of the trees, but sometimes spreads through the entire crown, involving the loss of almost all the young needles. Feeding for 1 year reduces growth, and if it is continued for 2–4 years results in the death of the youngest shoots, causing various types of malformation and stunting.

Only one general outbreak of spruce sawflies, which occurred in Skåne, had previously been recorded in Sweden, the species involved being probably *L. abietinus*. Infestation by *L. subarcticus* in Lapland was first observed in 1931 and increased steadily in distribution and intensity until 1934, when it covered 20,000 acres and practically every tree was attacked in the centres of greatest concentration. In 1935 the attack began to abate. The area of infestation is confined to high altitudes, the inland lakes within it being situated at 1,300–1,580 ft. with mountain peaks between rising to 2,620–3,280 ft. Sawfly outbreaks are probably dependent in the first place on such factors as weather and humidity of the soil in spring and early summer. The years of infestation by *L. subarcticus* were characterised by high temperature and scanty rainfall, particularly in June.

HUBAULT (E.). **Extension en France de** *Dreyfusia nüsslini* **Börner (Hemipt. Chermesidae).** *D. nüsslini* **et** *D. piceae*, **exemple de séparation d'espèces.**—*C. R. Soc. Biol.* **122** no. 24 pp. 1092–1094, 5 refs. Paris, 1936.

Chermes (*Dreyfusia*) *nüsslini*, Börner, has been established for some years on *Abies alba* in France, where the author has observed it in the hills of Lyonnais and at low altitudes in Lorraine, and appears to be spreading. It occurs in stands of trees in warm, open situations outside the natural range of the silver fir, where the foliage is poor and the trees susceptible to attack. It is possible that other hitherto unnoticed infestations exist in France, and it seems doubtful whether the planting of silver firs at low altitudes should be continued.

The author gives an account from the literature of the full cycle of development of this Aphid, and compares it with *C.* (*D.*) *piceae*, Börner, giving also brief notes on other Aphids that illustrate the evolution of anholocyclic development.

Picea orientalis is the primary food-plant of *C. nüsslini*, and *Abies* spp. (*A. alba* or *A. nordmanniana*, of which the latter is preferred) are the intermediate ones. In June, winged sexuparae fly from *Abies* and oviposit on *P. orientalis*. The sexual forms from their eggs mature during July and, after pairing, each female deposits a single egg at the base of the new shoots, which, in early August, gives rise to the fundatrix. The fundatrix attaches itself to a bud, but does not mature and oviposit until the following spring. The feeding of the fundatrices

and their progeny among the scales of the opening buds causes the formation of galls, in which the young Aphids develop as gallicolae. Eventually they emerge, become winged and migrate to *Abies*. Here apterous forms may be maintained indefinitely by parthenogenetic reproduction, but in the following year alate sexuparae may again occur, which migrate to *P. orientalis*. The complete cycle occupies 2 years. If the alate Aphids from *Abies* settle on *P. excelsa* instead of *P. orientalis*, they either die or produce infertile sexual forms.

C. piceae, which has long been known in Europe, also infests *Abies alba*, but reproduces indefinitely by parthenogenesis, its original principal food-plant (presumably a spruce) being extinct. Occasionally it gives rise to winged migrants, but these are not sexuparae and reproduce only on *A. alba*. The difference between these two Aphids is greater than it would be if they were two forms of the same species, one of which had been isolated on the intermediate food-plant by the extinction of the primary one in the vicinity. Distinct morphological differences exist, in addition to the fact that *C. piceae* no longer produces sexuparae. *A. alba* is considerably more sensitive to the attack of *C. nüsslini*, a recent importation from the Caucasus and Asia Minor, than to that of *C. piceae*, to which it has been subject for a long time.

Hering (M.). **Die Blatt-Minen Mittel- und Nord-Europas.** [The Leaf-mines of Central and North Europe.]—Lief. 3, pp. 225–336, 91 figs., 2 pls. Neubrandenburg, G. Feller, 27th August 1936. Subscription Price, *M.* 9 per Lieferung ; separately *M.* 13·5. (In Germany and Switzerland *M.* 12 & *M.* 18.)

In this third part of a series of keys to leaf-mines caused by insects [*R.A.E.*, A **24** 17, 405], keys are given from *Forsythia* to *Myrica*.

Papers noticed by Title only.

Pesson (P.). **Contribution à l'étude du tube digestif des Coccides. ii. Lecanines.**—*Bull. biol.* **69** no. 2 pp. 137–152, 4 figs., 13 refs. Paris, 1935. **iii. Monophlébines :** *Icerya purchasi*, **Mask.**—*Bull. Soc. zool. Fr.* **61** no. 4 pp. 282–293, 5 figs., 16 refs. Paris, 5th July 1936. [*Cf. R.A.E.*, A **22** 207.]

Neves (M.). **Contribution à l'étude des Coccides du Portugal—I.**—*Bull. Soc. portug. Sci. nat.* **12** no. 9 pp. 59–61, 1 fig., 1 pl. [Lisbon] July 1935. [Recd. August 1936.]

Ciślik (W.) & Kawecki (Z.). **Das spontane Auftreten der Blutlauszehrwespe** *Aphelinus mali* **Hald. in Polen.** [The spontaneous Appearance of *A. mali* in Poland (parasitising *Eriosoma lanigerum*, Hsm., on apple in 1935).]—*Bull. int. Acad. Cracovie* (B II) 1935 no. 8–10 pp. 343–345, 1 pl., 6 refs. Cracow, 1935. [*Cf. R.A.E.*, A **24** 131.]

Sasaki (C.). *Anoecia karatanei*, **a new gall-producing Aphid** [on *Magnolia fuscata*].—*Proc. imp. Acad. Japan* **12** no. 4 pp. 103–104, 3 figs. Tokyo, April 1936.

Leonard (M. D.). **Additions to the New York State List of Aphids with Notes on other New York Species.**—*J. N.Y. ent. Soc.* **44** no. 3 pp. 177–185. New York, N.Y., September 1936.

PALMER (M. A.). **Four new Aphids from Colorado.**—*Ann. ent. Soc. Amer.* **29** no. 2 pp. 273–278, 4 figs. Columbus, Ohio, June 1936.

FISHER (R. A.). **The Effect of a few Toxic Substances upon the total Blood Cell Count in the Cockroach, *Blatta orientalis* Linn.**—*Ann. ent. Soc. Amer.* **29** no. 2 pp. 335–340, 6 refs. Columbus, Ohio, June 1936.

MILNE (P. S.). **A Device for the rapid Counting of large Numbers of small Insects.**—*Bull. ent. Res.* **27** pt. 2 pp. 269–271, 1 pl., 1 fig. London, July 1936.

BRYSON (H. R.). **Technique for rearing subterranean Insects.**—*J. Kans. ent. Soc.* **9** no. 3 pp. 73–84, 1 pl., 18 refs. McPherson, Kans., July 1936.

SUBKLEW (W.). **Beziehungen zwischen der Lebensfähigkeit der Larven von *Melolontha melolontha* L. und *Melolontha hippocastani* F. und dem Salzgehatt des Ausssenmediums.** [The Relations between the Viability of the Larvae of *M. melolontha* and *M. hippocastani* and the Salt Content of their Surroundings.]—*Z. Forst- u. Jagdw.* **68** pp. 145–162, 1936. (Abstr. in *Z. PflKrankh.* **46** no. 8 p. 389. Stuttgart, 1936.) [*Cf. R.A.E.*, A **24** 653.]

DINGLER (M.). **Kurzes Nachwort zu meinen Arbeiten über die tierischen Spargelschädlinge.** [A short Supplement to my Papers on the Animal Pests of Asparagus in Germany.]—*Z. angew. Ent.* **23** no. 2 pp. 330–331. Berlin, July 1936. [See *R.A.E.*, A **24** 50.]

BRANDT (H.). **Ein einfaches Merkmal zur Feststellung des Geschlechtsverhältnisses von Kiefernspannerpuppen.** [A simple Character for ascertaining the Sex of Pupae of *Bupalus piniarius*, L.]—*Anz. Schädlingsk.* **12** no. 6 pp. 72–73, 1 fig. Berlin, June 1936.

TRÄGÅRDH (I.). **Finnas förutsättningar för maskinell bekämpning av skogsinsekter i Sverige ?** [Are Conditions suitable in Sweden for the Control of Forest Pests by Aeroplane or Power Dusting ?]—*Svenska SkogsvFören. Tidskr.* 1936 no. 1 pp. 108–132, 2 graphs. Stockholm, 1936. (With a Summary in German.) [*Cf. R.A.E.*, A **24** 109.]

ROARK (R. C.). **Review of United States Patents relating to Pest Control** [issued January–June 1936.]—**9** nos. 1–6 ; 6, 7, 8, 8, 10, 10 pp. multigraph. Washington, D.C., U.S. Dep. Agric., Bur. Ent., 1936.

SMITH (R. C.). **The Influence of Civilization on the Insect Fauna in Cultivated Areas of North America.**—*Rep. Smithson Inst. 1934* pp. 257–266, 15 refs. Washington, D.C., 1935. (Repr. *Ann. ent. Soc. Amer.* **26** no. 3, 1933. [See *R.A.E.*, A **21** 652.])

METZGER (F. W.). **Traps for the Japanese Beetle** [*Popillia japonica*, Newm., in the United States] **and how to use them.**—*Misc. Publ. U.S. Dep. Agric.* no. 201 (revd) 12 pp., 5 figs. Washington, D.C., February 1936. [Recd. July 1936.] [*Cf. R.A.E.*, A **22** 633, etc.]

CHEVALIER (J.). **Les plantes à roténone. Leur utilisation comme insecticides.** [A general review of the literature.]—*Bull. Sci. pharm.* **43** no. 5 pp. 259–270. Paris, May 1936.

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BULLETIN DU COMITÉ D'ETUDES HISTORIQUES ET SCIENTIFIQUES DE L'AFRIQUE OCCIDENTALE FRANÇAISE (PARIS): Année 1919, No. 1.

CALIFORNIA AGRICULTURAL EXPERIMENT STATION (BERKELEY, CAL.):
Circulars 14 and 42 (1905–09).

CANADA: DEPARTMENT OF AGRICULTURE: EXPERIMENTAL FARMS:
Fletcher (J.). Reports of the Entomologist and Botanist for the Years 1886 and 1888 (Ottawa, 1887–89).

CHACARAS E QUINTAES (SÃO PAULO): Indices to Vols. X, XI, XII and XIV; XLII, No. 3.

COMPTES RENDUS DES SÉANCES DE L'ACADÉMIE D'AGRICULTURE DE FRANCE (PARIS): Tome VIII (1922) No. 5.

EGATEA, REVISTA DA ESCOLA DE ENGENHARIA DE PORTO ALEGRE, BRAZIL:
Vols. I–VI (1916–21); VII (1922) Nos. 1–5; VIII (1923) Nos. 2–5; IX (1924) Nos. 1, 4–6.

ENTOMOLOGICA AMERICANA (BROOKLYN, N.Y.):
Vol. IV (1888) Title-page. Vol. V (1889) Nos. 6 & 8.

ENTOMOLOGISCHE LITTERATURBLÄTTER (BERLIN): 6 Jahrg. (1906). Nos. 2 & 10.

EXPERIMENT STATION RECORD (WASHINGTON, D.C.): Vols. I–IV (1889–94).

GEORGIA STATE BOARD OF ENTOMOLOGY (ATLANTA):
Bulletin: 2, 6, 22 and 28. Circular: 1 to 3, 12, 15 to 18 and 20.

GRASSI (B.) et al. Contributo alla conoscenza delle Filloserine ed in particolare della Fillossera della Vite (Rome, 1912).

INDIA: FOREST RESEARCH INSTITUTE (DEHRA DUN).
Forest Bulletin (Old Series): Nos. 1–3.

INDIAN MEDICAL GAZETTE (CALCUTTA):
Vol. L (1915) No. 10; LI (1916) Nos. 1–7, 10; LII (1917) No. 7 and title-page & index; LIII (1918); and LIV (1919) No. 2.

INDIANA: Third Annual Report of the State Entomologist, 1909–10.

JOURNAL OF THE BOARD OF AGRICULTURE OF BRITISH GUIANA (DEMERARA):
Vol. III No. 1 (1909). Title pp. and Indices to Vols. I–II.

JOURNAL OF THE SOUTH-EASTERN AGRICULTURAL COLLEGE (WYE, KENT):
Nos. 1–6, 8, 11–13 (1895–1904).

KENTUCKY AGRICULTURAL EXPERIMENT STATION (LEXINGTON, KY.):
Bulletin Nos. 21 (1889), 31 (1890), 47 (1893), 53 (1894), 74 (1898) and 91 (1901).

THE KENYA AND EAST AFRICAN MEDICAL JOURNAL (NAIROBI): Vol. II, Nos. 2–3 (1925).

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